SCIENTIFIC AMERICAN

(Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1907, by Munn & Co.)

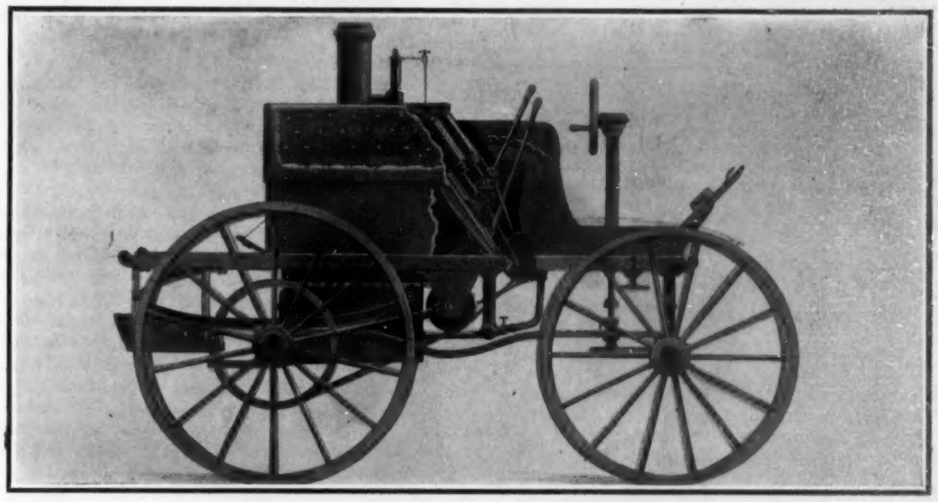
Vol. XCVI.—No. 2. ESTABLISHED 1845.

NEW YORK, JANUARY 12, 1907.

[10 CENTS A COPY $3.00 A YEAR

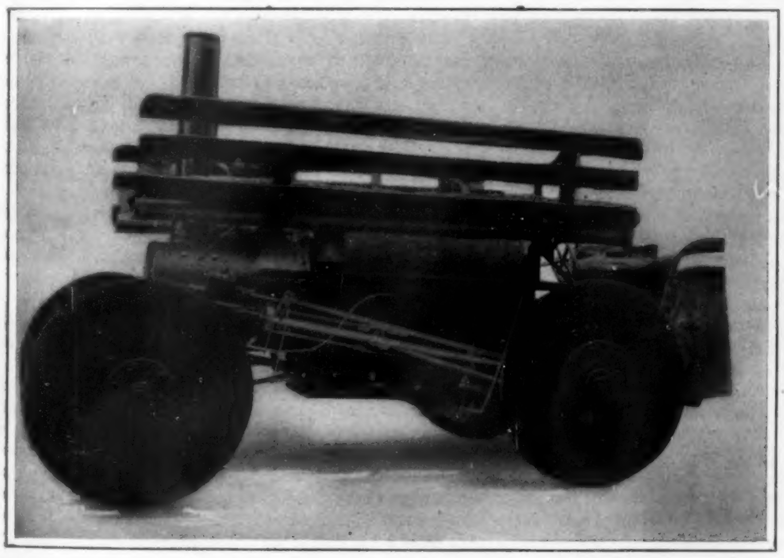
A. L. Riker's Electric Tricycle, Built Twenty Years Ago.

A small battery motor drove the large wheel by friction.



The House Brothers' Steam Wagon of Forty Years Ago.

This is the first machine built along the lines of the present-day automobile.



Richard Dudgeon's Steam Road Car, Built in 1860.

The original machine, of which this is a duplicate, was constructed in 1855.

Mr. R. E. Olds' First Gasoline Machine, Built in 1896.

The 5-horse-power motor and 3-speed transmission were arranged on the running gear.

Mr. Elwood Haynes's First Gasoline Automobile, Built in 1893.

One of Mr. Charles E. Duryea's Oldest Gasoline Machines, Built in 1893.

SOME OF THE FIRST AMERICAN STEAM, ELECTRIC, AND GASOLINE AUTOMOBILES.—[See page 23.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico........$3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS

Scientific American (Established 1845)........$3.00 a year
Scientific American Supplement (Established 1876)........5.00 "
American Homes and Gardens........3.00 "
Scientific American Export Edition (Established 1878)........3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JANUARY 12, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CAPE COD CANAL.

Attention has been again directed to the project for cutting a ship canal across Cape Cod, by the recent announcement that a prominent financier, who controls the transportation interests in this city, has become interested in the scheme, and is prepared to furnish the necessary capital to put it through. It takes only a glance at the map of the New England coast to understand why the opening of this canal is desired both by maritime and naval interests, and particularly by the former. The passage from Long Island Sound to Boston and northern New England ports must now be made around Cape Cod, where navigation is rendered perilous by the stormy waters, the fogs, and the swift tides off the Cape. Moreover, the cutting of the canal would shorten the distance between New York and Boston by one hundred and forty miles on the sea route, and by seventy-six miles over the route through the Sound. It is estimated that at present the annual tonnage of coastwise trade which passes around Cape Cod is about 22,000,000 tons. As the greater part of this consists of coal, it is certain that the opening of the canal would mean the supplying of fuel to the mills of northern New England at a considerably lower rate than is now possible. The advantage to passenger traffic would lie in the fact that travelers who left New York in the evening would be landed in Boston next morning without having to make the uncomfortable early morning change from boat to train.

Commencing at Buzzard's Bay, the route of the canal extends across the narrowest part of Cape Cod to a terminus at Barnstable on Massachusetts Bay. The entrance on Buzzard's Bay will call for about 4½ miles of dredging through the shoals, and the length of the canal proper from shore to shore will be about 7½ miles; the total length of the canal, from deep water to deep water, being thus about 12 miles. The survey follows the valleys of two rivers, with a maximum deviation of not more than half a mile on each side of a tangent drawn from terminus to terminus.

The canal is to have a depth, throughout, at low tide of 25 feet. The minimum width at the bottom is to be 125 feet, and there will be four passing stations to accommodate vessels going in opposite directions, where there will be a maximum width of 350 feet on the surface. The borings, which have been of a very extensive character, indicate that the sub-surface is composed entirely of gravel, sand, and loam, free from quicksands, rock ledges, and bowlders. The average height of the ground above tidewater level is 9 feet, and it is the easy character of the excavation which accounts for the comparatively low estimated cost of the canal, which can be built in three years at an outlay of $12,000,000.

An important point to be considered in connection with any canal in the Northern States is that of the formation of ice during the coldest weather of the winter. Fortunately, there is a variation of four feet in the respective rise and fall of the tides in Buzzard's Bay and in Massachusetts Bay, the range being about 9 feet in the former and 5 feet in the latter waters. Moreover, the times of high tide are different. There will, therefore, be a constant current through the canal which, with the passage of shipping, will serve to prevent the canal from being closed by the ice.

THE PENNSYLVANIA AND NEW HAVEN CONNECTING RAILROAD.

Seldom has a franchise been granted by the city of New York of greater importance than that recently conceded for what is known as the New York Connecting Railroad. The line has been designed to form a link between the Pennsylvania and New Haven and Hartford Railroads, and it is to be operated ultimately in conjunction with the tunnels which the Pennsylvania Company is now building between Jersey City and Long Island. This system of tunnels, including the terminal station, is, however, designed exclusively for passenger traffic; whereas the avowed purpose, for the present at least, of the Connecting Railroad is to form a connecting link for the transfer of freight traffic between the two railroads.

At present, the method of transfer of freight from the New England territory to the Pennsylvania system is by means of large car floats, which are towed down the East River and across the Bay to the Pennsylvania freight yards in New Jersey. Under the new arrangement, the New England freight will be taken from Jersey City across the Bay to Bay Ridge, where the cars will be transferred to the Long Island Railroad tracks and hauled to Sunnyside, a suburb of Long Island City. The connecting railroad will start from this point, and will be carried by means of a viaduct to a point opposite Ward's Island, where it will cross the East River by means of a massive four-track arched bridge, with 150 feet clearance above the river, and a single span of 1,000 feet. From Ward's Island the tracks will be carried at high level to the Mott Haven yards of the New Haven system. This arched bridge, which has been designed by Gustav Lindenthal, the late Commissioner of Bridges, will be the largest arched bridge of any kind ever built, being 200 feet greater in span than the 800-foot arched highway bridge at Niagara Falls.

Although the connecting railroad is designed primarily, and will have its first use, as a freight line, there is little doubt that ultimately it will serve to give the New Haven passenger trains an independent entrance to their own terminal station in New York city. Recent heavy purchases of real estate in the neighborhood of Thirty-fourth Street and Park Avenue are believed to mark the beginning of a scheme for building a new passenger terminal for the New Haven system at this spot. It has for many years been evident that the Forty-second Street Grand Central Station, even when the proposed enlargements are completed, must ultimately become insufficient to accommodate the rapidly-growing passenger service of two great systems, and that the New Haven Company must, sooner or later, seek an independent terminus. The locality will be admirably placed for the convenience both of the railroad and the traveling public; for the passenger trains will be run over the Ward's Island bridge, to Long Island, and through the Thirty-fourth Street East River tunnel of the Pennsylvania Company to the new Park Avenue station, where passengers will be in direct communication with the underground rapid transit system of the city.

THE SEVENTH NATIONAL AUTOMOBILE SHOW AT MADISON SQUARE GARDEN.

To the student of the art of automobile manufacture, the annual exhibition at the Madison Square Garden affords an unrivaled opportunity, not merely for observing the progress of the year, but of forecasting the probable trend of development in the future. In the present issue of the SCIENTIFIC AMERICAN we have endeavored to illustrate the machines and the parts and accessories, which, because of their novelty and importance, illustrate both the progress of the year and the present state of the art. In summing up the impressions of the Show, we find that the general trend of improvement is in the following directions.

In the contour or outline of the cars, one notes a disposition to avoid the curved lines of the earlier cars, and accentuate the rectilinear lines, particularly in the horizontal direction. In this we see an instinctive appreciation of the fact that an automobile belongs more to the class of the locomotive than that of the carriage. When steam railroad trains were first introduced, the car bodies were modeled after the stage coach, the early cars being simply stage coach bodies mounted upon flanged wheels; but ultimately it was realized that the simple, vertical and horizontal lines, which now distinguish the railroad car, were more suitable to its structural requirements and produced a better looking vehicle. So, in the development of the automobile, it is coming to be realized that the longer bodies and straight lines produce a car, which is not only, if we may use the term, more shipshape, but which possesses more of that inherent beauty that belongs to a properly proportioned self-propelled vehicle, whether it be intended for use upon steel rails, or upon a macadam road.

The improved appearance of this year's cars is largely aided by the considerable increase in the wheel base which, in the case of some of the heavier machines is now as great as 123 inches. Furthermore, the use of six-cylinder motors has brought with it a considerable increase in the length of the bonnet, and this also adds to the generally rakish and smart appearance of the up-to-date machine. By a judicious attention to these principles, the builders of even the low-powered and low-priced machines have succeeded in giving to their output a style, which was altogether lacking in the earlier models. Other elements which have helped to improve the appearance are the better designed mud guards, which are now frequently brought up to a junction with the frame of the cars, and are designed in long, easy, sweeping lines of decided grace and beauty, and the provision of continuous running boards in place of the earlier and rather crude-looking step, which, like the curved car bodies, was a relic of the carriage builder's influence.

The detachable or folding tops for summer use, and the closed and semi-inclosed bodies for winter, have become standard; and, thanks to the care with which the carriage builders have accommodated the bodies to the necessities of the chassis, the majority of the automobiles shown are marked by no little beauty and distinction.

We notice a tendency to increase the diameter both of the wheels and the tires, particularly of the rear wheels. It is not unlikely that in the future the prevailing custom will be to make the front wheels and tires smaller than those at the rear. In some machines the diameter of the rear tires has reached the rather high limit of 5 inches; although at its first introduction, this size rather detracts from the graceful and otherwise well-proportioned appearance of the cars. The disastrous failure of American nonskid tires in the Vanderbilt cup race proves nothing material against such tires when used on touring cars, as the experience of the past year has proved that the best makes are capable of showing excellent endurance under the severe test of the roads of this country. Considerable attention is being given to the subject of shock absorbers, most of these being designed to operate by friction, and others by air on the method of the well-known door check; while a meritorious attempt is being made to apply the principle of the hydraulic brake as used in checking the recoil of heavy guns. A novelty in shock absorbers is a device which consists of a central cylinder, containing brake shoes, associated with two smaller cylinders provided with compound springs, the slight vibrations being absorbed by the springs, while in the heavier shocks the springs and brake shoes act together to retard the rebound.

Although the four-cylinder, vertical, water-cooled engine must still be reckoned as the standard type, the six-cylinder engine has unquestionably come to stay, the advantages of more even torque and better control offsetting, in the opinion of its votaries, the disadvantages of greater weight and multiplication of parts. A refinement of design based on good mechanical considerations, is the tendency to unify the engine and transmission by inclosing both in a single housing, mounted on a three-point suspension. In one instance, the flywheel is mounted at the forward end of the engine, this change being made to avoid the enlargement of the casing which is necessary when the wheel is carried between the engine and the transmission.

There is an increasing use of the shaft drive, although many of the old-time, standard cars show a preference for the side chains. One maker, in the endeavor to secure the dust-proof qualities of the shaft drive, has inclosed the chains in a dust-proof shield, a device which was found to have valuable qualities on the bicycle, and should prove of even greater value in prolonging the life and reducing the resistance of automobile chain drives. There is noticeable a more general adoption of ball-bearing crankshafts, the favored type being the spring-separated, one-ring bearing. Ball bearings are also being extensively used on the transmission, the rear axles, and the wheels. Several novel and important designs of transmission are shown, some of these providing four speeds with the direct drive on the third speed; the fourth speed giving multiplication from the engine to the wheels and being used for fast traveling.

In carbureters there are also several improvements, among which we noticed the use of multiple jets, or the adoption of two distinct carbureters of different sizes, the smaller one being used for ordinary running at low power, and the larger one for high speed or hill climbing.

One of the novelties this year is a new gasoline-electric touring car brought out by one of the oldest New England firms and one which has had considerable experience with electric vehicles. This car is provided with the usual 4-cylinder engine which is direct-connected to a dynamo forming a magnetic clutch. In ascending hills the magnetic clutch is allowed to slip to a greater or less extent, and the current generated is passed to an electric motor which helps to propel the car at a slow speed but with increased pull, while the full torque of the engine is still transmitted directly through the propeller shaft to the rear axle. The car is fitted with five forward and two reverse speeds and an electric brake. The advantage of this construction is that a large percentage of power of the engine is always used direct without its efficiency being reduced, by conversion into electricity, and then back into mechanical power. The magnetic clutch acts in the same way as a friction clutch, but there is no contact between the driving and driven part of the clutch, and consequently, no frictional loss through slipping.

Cars of this type have frequently been experimented with abroad, but this is one of the few instances in which they have been developed in this country.

The advocates of the two-cycle engine are represented by a new touring car with three cylinders, for which they claim to secure the same horsepower as can be developed with six cylinders of the same diameter and stroke. It goes without saying that structurally the two-cycle is a far simpler engine than the four-cycle, and theoretically it should, on the same cylinder capacity, give double the power. Hitherto, however, the difficulty of getting rid of the exhaust before the introduction of the fresh charge, has rendered it impossible to bring the brake horsepower up to the theoretical horse-power. It is claimed that in the engine above referred to, and in some other new designs of the two-cycle type, this problem has been satisfactorily solved. As against this and other losses, there is a distinct gain in respect of the heat losses through radiation, which must necessarily be less because of the reduction of cylinder surface. There is also an obvious gain in reduction of parts and wearing surfaces, to say nothing of the weight. A commendable two-cycle engine was exhibited at the recent Grand Central Palace Show as applied to motor trucks. In this engine the charge is directed up through the center of the piston, being admitted to the latter through a port in the cylinder walls.

A simplification and decided improvement in valve mechanism is obtained by the use of walking-beams operating pairs of valves set in the cylinder heads, the valves of each pair being on opposite sides of the center line of the engine. This permits of the operation of the valves, say of a four-cylinder engine, with four instead of eight cams and rods, the whole being operated from a single camshaft.

Low tension ignition is not widely used. Indeed, it has not had the vogue which was predicted for it at the time of the exposition one year ago. The prevailing practice is to use the high tension jump-spark with the magneto; although some makers prefer to use two separate systems, with separate plugs for the battery and coils and for the magneto.

SOME EARLY AMERICAN AUTOMOBILES.

STEAM MACHINES.

One afternoon in the late autumn of 1855 three men whose names add luster to the history of the mechanic arts were discussing the feasibility of building an automobile wagon. Each agreed that such a vehicle was practicable, and each asserted that if put to it he would produce a self-propelling carriage that would meet every needed requirement. The discussion resulted in an odd wager, which was that all three should build a self-moving wagon, and to the one whose effort was most successful the award should be made.

The trio which entered into this strange compact was composed of the late Richard Dudgeon, famous as the inventor of the hydraulic jack; William Fletcher, the best-known builder of steamboat engines in his day; and another great inventor to whom the world owes much, "Boss" Hudson, of the Rogers Locomotive Works. Each set to work at the task with enthusiasm, not for the possible profits that success might have yielded, but much after the manner of three boys doing "stunts," each zealous to outdo his companions in friendly rivalry.

Before long the three wagons were completed, and queer enough they must have looked in those days, when even the locomotive was in many parts of the country a curiosity. It would be to no purpose to describe the machines of Fletcher and Hudson, since they were both failures, holding however within themselves, no doubt, great latent possibilities, had the spirit of the times encouraged further efforts. But the Dudgeon machine was perfect in every point. Of course, it was not the finished, graceful, triumphant vehicle that to-day glides by with scarcely a whirr to tell of its passing; but then the automobile of the present is the fruition of years of endeavor, whereas the Dudgeon machine was but the hasty effort of an inventor—with limited tools and devices to fashion the necessary parts—to give concrete expression to his theory of how such a vehicle should be constructed.

This machine, it is claimed, traveled forty miles an hour, and it is said to have been under perfect control when "rushing" over the roads at the rate of thirty-five. When we recall that only a few years back the sight of an automobile caused the average citizen to stand in his tracks and note it with open-eyed wonderment, it is not difficult to imagine the impression made upon the populace of Manhattan Island by this strange device, that swept through Broadway and startled both man and beast.

Unfortunately, this original wagon was destroyed in the memorable fire that caused the destruction of the Crystal Palace, for it was there on exhibition; and to old New Yorkers, at least, it need scarce be said that it was not the least inspected of the many wondrous things gathered under the roof of that historic edifice. But the inventor was not dismayed by its loss; for the embers of the machine had scarce stopped smoldering when he was at work upon a second wagon—the one here illustrated. This machine was completed in 1860, and soon became a familiar sight as it puffed and snorted through the upper section of Manhattan Island, through which the owner and inventor was wont to "exercise" it.

It is an exact duplicate of its prototype, which was given birth under such strange conditions, and is to-day just as it was when turned out of the shop, save that fifteen years ago its rust-caked boiler was replaced by a new one. This wagon, it should be added, was a product of the days when mechanical appliances in the machine shop, the carriage builder's, or the wheelwright's were few in number, so that it was practically made by hand.

The solid cedar wheels, it will be observed, are in a remarkable state of preservation, the tires not having expanded perceptibly since they were shrunk on forty-five years ago.

It will be interesting to engineers and mechanics to learn that it was while at work on this wagon that its inventor conceived the idea of the roller-tube expander, which, together with his hydraulic jack, have made the name of Richard Dudgeon secure in an honored place in the history of this country's inventors. A brief description of his automobile is appended.

The engine, which develops 8 to 10 horse-power, was built in accordance with the locomotive design common during the period of its construction. The boiler is of the ordinary locomotive type. The cylinders, two in number and located one on each side of the forward end of the boiler, are of 4½-inch bore, with ordinary slide valves. The cut-off of the latter is adjusted by a shifting link. The stroke is 18 inches, and the crossheads slide on two rods extending from each cylinder, which is set at an angle with the horizontal. The cranks are directly on the rear axle, which likewise carries the valve eccentrics, and the connecting rods thus extend from the crossheads to the rear axle.

The machine is guided from the driver's seat, located at the rear end of the machine, by means of a steering wheel like that of the automobile of to-day. The steering is done by turning the front axle through the usual intermediate gearing. The throttle for governing the speed is of the common locomotive type.

Ten passengers can be carried on two longitudinal seats or benches, above and on each side of the boiler, as appears from the accompanying illustration. Under each bench is a long metal water tank to supply the boiler. The fuel (coal) is carried in a sort of cab at the rear of the machine, in which also the driver's seat is placed. The smokestack, like that of the ordinary locomotive, is located at the forward end of the boiler. The firebox is of the ordinary design, and is located at the rear. The whole machine is carried by leaf springs.

Another steam machine that was planned a decade later than the first Dudgeon car, and that was eventually constructed and run over the roads in and around Bridgeport, Conn., in 1866, was that of the House brothers (James A. and Henry A.)—inventors who were at that time actively engaged with the firm of Wheeler & Wilson in perfecting the sewing machine. The House steamer, as can be seen from the drawing, was in several respects like the modern automobile. It had, for example, a double side chain drive from a countershaft to the rear wheels, the engine was placed under the seat, and the steering was accomplished by a wheel at first, though a lever was afterward resorted to on account of its quicker action and greater sensitiveness. The entire front axle was swung on a fifth wheel by means of a chain that ran from one end of the axle back around horizontal sprockets on the reaches and then forward to the other end of the front axle. One of these sprockets was on the lower end of the vertical steering column, which was provided near the bottom with a double sliding universal joint and turned by a vertical wheel on top connected with it through a worm gear. After running through fences several times owing to their wheel steering device not being quick enough, the inventors placed a lever directly on the vertical shaft, and afterward experienced no more trouble. The machine steered very easily, as most of the weight was on the rear wheels and when it was running the front wheels rested lightly on the ground.

The boiler used on the House machine was of the regular fire-engine fire-tube type, but it was noteworthy as being the first steel shell boiler to be constructed in the vicinity of New York. The boiler was built in Bridgeport, Ct. It was tested hydraulically to 300 pounds pressure, and ordinarily carried this pressure when used on the machine. The gage on the footboard indicated only half this amount, however, as people at that time were afraid to ride alongside of a boiler carrying 300 pounds of steam. A pop safety valve was fitted, but this used to scare so many horses that it was taken off and the regular spring-and-lever, locomotive type (which could be held down when a horse came in sight) was substituted. The boiler was fired with a mixture of cannel coal and charcoal from a seat placed transversely behind it for the fireman. On each side of the boiler was an upholstered seat capable of accommodating two persons. Besides the driver and fireman, five passengers could therefore be carried. The fuel was placed in an inclined box built around the boiler, and the water in a tank forward and under the fuel.

The motive power consisted of a twin-cylinder, double-acting, slide-valve steam engine having a 4¼-inch bore by 6-inch stroke. The connecting rods worked on disk cranks and the engine was provided with the usual link valve gear. The throttle and reverse levers were brought up through the middle of the front seat. There were two chains from the engine shaft to the countershaft, either of which could be put in use by means of jaw clutches on the latter. With one of these a speed reduction of 3 to 1 was had from the crankshaft to the countershaft, while with the other, or high speed, a similar increase was obtained. In order to allow for the differential movement of the wheels in turning corners, the brothers drove the sprockets on the countershaft through a double-acting ratchet and pawl, which answered for both forward and backward motion. When in the backing position the engine could be used as a brake. The machine had no brakes, the reverse being used for this purpose and enabling a very quick stop to be made. To reverse the car, all that was necessary to do was to kick the ratchet reverse lever on the footboard to one side, set the links of the engine with the reverse lever beside the seat, and open the throttle.

There were two water gages placed beside the boiler, one back of the front seat for the driver and one behind the boiler for the fireman. A variable-speed pump was driven from the engine by a slotted lever connected to the crosshead. The pump connecting rod was attached to a block in this slotted lever, which could be set at different distances from the fulcrum of the lever and thus made to vary the stroke of the pump. This device was worked by the fireman. The engine complete with water pump, etc., weighed but 110 pounds, and so perfectly was it balanced that Mr. Henry House states he could lift it off the ground while it was running at the rate of 1,500 R. P. M. It developed about 12 horse-power in the machine, but if supplied from a boiler of sufficient capacity it would have developed fully 50 horse-power. The 12-horse-power actually attained was sufficient to send the machine along an ordinary country road at over 30 miles an hour. The best performance the brothers made with it was 5 miles in 10 minutes. The weight of the machine complete, with water and fuel sufficient for a 10-mile run, was 1,800 pounds.

THE FIRST ELECTRIC AUTOMOBILE.

To Mr. Andrew L. Riker belongs the credit of having devised and run the first electric automobile in America. When abroad in 1886, he brought home from England a Coventry tricycle, to which, the following year, he applied a 1/6-horse-power battery motor of his own make in the manner shown on our front-page illustration, and thus produced a motor-driven tricycle capable of a speed of 8 miles an hour on good roads. The 8-volt motor drove the large wheel of the tricycle by means of a grooved pulley that fitted the solid rubber tire. The motor was mounted on a long arm, which, as the motor tended to climb the wheel, drew it tighter against the latter and thus increased the friction. The four cells of storage battery were carried in a box mounted on the frame of the tricycle. Their capacity was sufficient to run the machine for four hours, so that a 25-mile ride could easily be taken on level roads. From this first simple machine, within a decade, Mr. Riker advanced to the manufacture of the first successful electric automobile built in this country. Afterward he turned his attention to gasoline cars, with which he has also been very successful, one of the racing cars of his design having won third place in the Vanderbilt cup race of 1905.

EARLY GASOLINE CARS.

One of the photographs reproduced on our front page shows Mr. Charles E. Duryea's second gasoline automobile, which was constructed in 1893. This was one of the first crude attempts at converting an ordinary horse-drawn phaeton into a motor vehicle. The engine was placed horizontally beneath the center of the vehicle at the rear. It was a single-cylinder engine, with the crankshaft placed vertically and with the flywheel located, as shown, on the under side. The original arrangement used was a friction drive, the face of the flywheel being used as the driving surface. Parallel to the lower face of the flywheel was a drum on a countershaft. Between this drum and the flywheel was fed a loose belt, the speed of which, and consequently of the drum, was determined by the distance out from the center of the flywheel. The flywheel was hollowed out a little at the center, to re-

(Continued on page 50.)

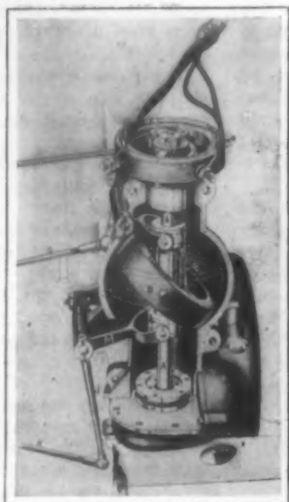
ENGINES

THE CADILLAC 20-HORSE-POWER FOUR-CYLINDER ENGINE AND GOVERNOR.

BY WALTER GALLAND.

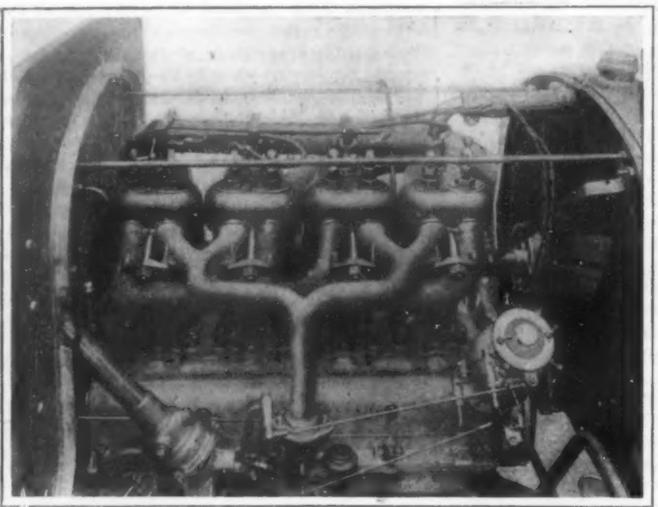
The motor of the new Cadillac light touring car, which we illustrate herewith, follows rather closely in design the larger motor which has been used for the last two years upon the Cadillac heavy touring car. The cylinders are cast separately, and are fitted with copper water jackets. This arrangement, as is well known, gives a cylinder of uniform thickness throughout, and consequently one that can be cooled to advantage. The separate cylinders also have the advantage of being readily replaced in case of breakage. The valves are all mechanically operated from a single camshaft, and are placed side by side in valve chambers on one side of the motor cylinders. The exhaust and inlet pipes are clamped to the valve chambers by four bridge pieces held by single nuts as shown. The spark plugs are placed immediately over the inlet valves, and the priming cocks over the exhaust valves. The carbureter is of the automatic float-feed type. All valves are interchangeable, and each valve rod is provided with a hardened steel roller and pin. The connecting rods are H-section steel drop forgings. The crankshaft is also a steel drop forging, which is put through a special strengthening process to give it strength and toughness, and which also has its bearing surfaces carefully ground. The connecting-rod bearings are readily accessible by removing large covers in the aluminium crankcase. There are dividing walls and separate bearings between all the cranks. The bearings are attached to the upper part of the crankcase. The motor has a three-point suspension. Lubrication of the motor is by the automatic splash system, the supply of oil in the crankcase being maintained by a belt-driven force-feed lubricator mounted beside it. One of the main features of the Cadillac 4-cylinder cars is the governor, the use of which makes it possible to set the car at any given speed, and have it maintain that speed when running up or down hill as well as on the level. The governor, which is of the automatic ring type and which is described in detail on another page, can be seen in the illustration of the motor at the forward end. It is inclosed in a globe-shaped casting that is surmounted by the commutator, and the connections from the governor to the carbureter and from the commutator to its shifting lever are plainly to be seen. Both spark and throttle levers are located on sectors in the steering wheel, and are connected by means of solid and hollow rods passing through the steering column to suitable levers seen at its base. The car is also provided with an accelerator pedal for suddenly increasing its speed by throwing the governor out of action. The governor, a perspective view of which is shown herewith, is built up

(*Continued on page 51.*)



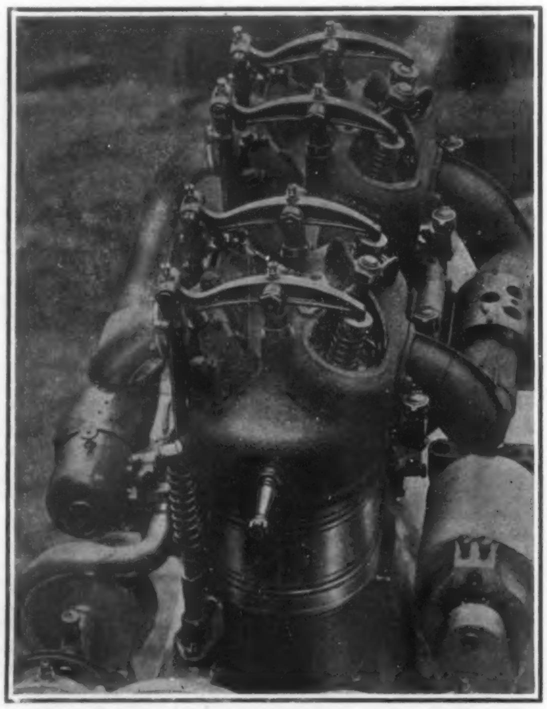
CADILLAC GOVERNOR AND TIMER.

A. Vertical shaft driven by bevel gears from half-speed cam-haft. *B*. Governor ring. *C*, *D*. Spring and link connecting *B* with collar *E*. *F*, *G*. Lever and rod making connection with throttle. *H*, *J*, *M*, *L*. Rod, lever, shifting fork, and collar connected with accelerator pedal.



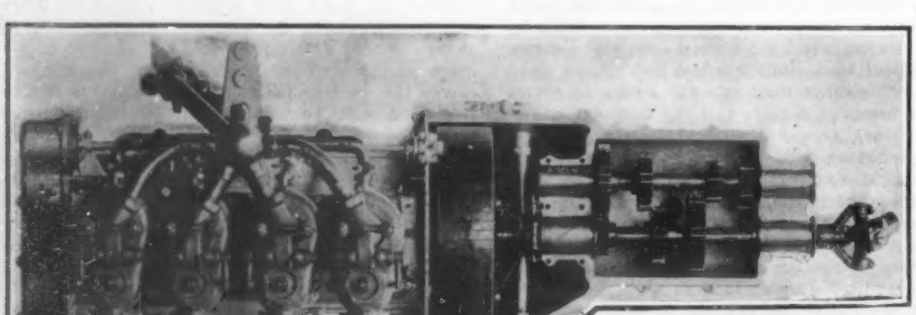
THE 20-HORSE-POWER ENGINE OF THE NEW CADILLAC LIGHT TOURING CAR, SHOWING STEERING GEAR, CARBURETER, AND GOVERNOR.

The cylinders of this engine are provided with copper water jackets which are clamped in place by the heads. The governor is seen in the globular casing on the right with connections extending to the carburet r and with the timer superposed. The belt-driven fan can be seen behind the radiator, and the steering column and carbureter beside the engine.



THE 50-HORSE-POWER ENGINE OF THE CAR DE LUXE.

The bore and stroke are 125 x 185 mm. (6.692 x 7.086 inches). Each pair of valves is worked from a single camshaft by means of the walking-beam arrangement shown. The water pump and magneto are gear-driven on opposite sides of the crankcase.



PLAN VIEW OF AUTOCAR COMBINED ENGINE AND TRANSMISSION WITH COVER OF TRANSMISSION REMOVED.

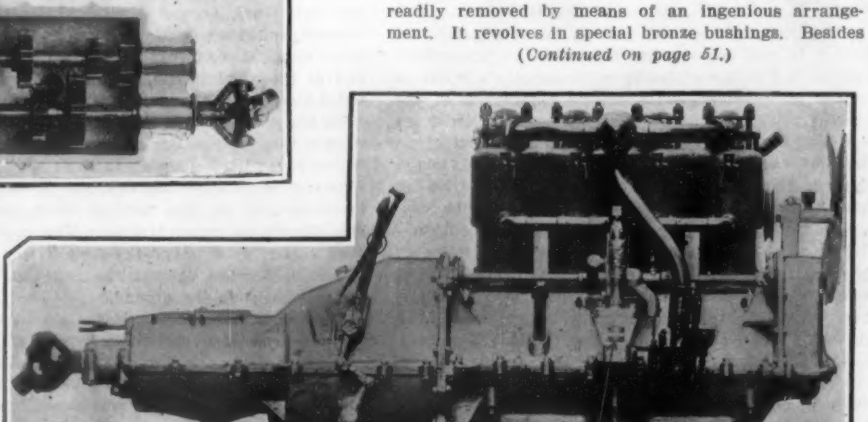
The inlet valves are in the center of the cylinder heads and are mechanically operated by incloeed tappets.

ENGINE OF THE CAR DE LUXE.

One of the highest grade machines at present being manufactured is the Car de Luxe, which is built in Toledo, Ohio, and Detroit, Mich. The photograph shows a top view of the engine, and displays prominently its several novel features. Some of these are the following: Corrugated copper water jackets, extending entirely around each pair of cylinders; valves arranged in the heads of the cylinders, and operated by walking beams; and Hess-Bright ball bearings in the crankshaft. This latter, as well as many other parts, is of chrome nickel steel. An inspection of the photograph will show the method of retaining the valves in the heads of the cylinders. The valve cages have ground joints, and rest upon copper gaskets. The inlet valve caps are secured by two bolts and nuts each, while the exhaust valve cages for each pair of cylinders are held in place by a single X-shaped piece secured by a single nut.

The enlarged, rounded part of the cylinder around the exhaust valves is where a special water jacket is cast for the purpose of keeping these valves cool. The walking-beam method of valve operation shown simplifies the construction considerably, and reduces the number of push rods and tappets to but four. Double cams, that is, cams having both a raised and a depressed surface, are used on the camshaft, so that immediately after the raised cam has caused the exhaust valve to open and close, the drop of the push-rod roller into the depressed cam causes the curved valve tappet to rock downward upon the inlet valve and open this at the proper time. This walking-beam method of valve operation was brought out on the Fiat cars a couple of years ago, and at the present time there are but one or two other firms which are using it. The valves, located as they are in the cylinder heads, are very accessible and can be readily removed. Another distinctive feature is the use of a special form of split piston ring. This ring is triangular in cross section, and there are six segments of a corresponding ring that fit within, and that tend to press it outward in all directions by means of flat steel springs that form chords of the six segments. The magneto is gear-driven by spiral gears from the half-speed camshaft, and is seen at the right of the motor, while the water pump is similarly located on the left-hand side. The magneto has a high-tension distributor at one end. A carbureter of the automatic type is located on the left-hand side and connected to the inlet valves. Spark plugs are screwed into sockets in the cylinder heads, as shown. A spindle projecting out from the front end of the head is for the fan, which is belt-driven and runs on ball bearings. The exhaust pipe is shown on the right-hand side of the engine. The camshaft is readily removed by means of an ingenious arrangement. It revolves in special bronze bushings. Besides

(*Continued on page 51.*)



SIDE VIEW OF COMBINED ENGINE AND TRANSMISSION, SHOWING LINES OF DIVISION OF THE CRANK AND GEAR CASES.—[See page 51.]

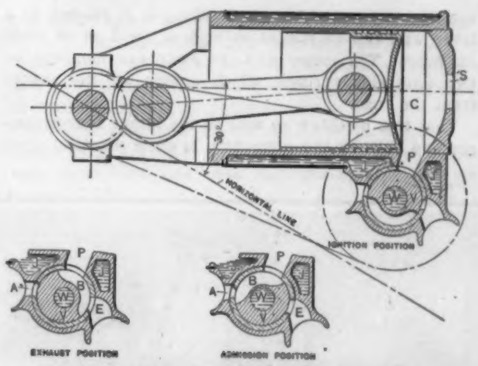
Two of the points of the 3-point suspension are shown at *A* and *B*. The rear point, *B*, is supported on a coiled spring on a cross member of the frame.

AN ENGINE WITH LOW-TENSION MAGNETO IGNITION.

The engine of the 35-horse-power Locomobile touring car, which is shown in the accompanying illustration, is a typical example of a 4-cylinder, vertical, water-cooled engine fitted with the simplest type ignition, namely, make-and-break, fed by current from a gear-driven magneto. The igniters are shown in the inlet chambers of the four cylinders as at *b*, while they are all operated by vertical rods, *c*, that are pushed upward by tapered cams in the crankcase, and that make a sudden descent in slipping off the cam and being pulled downward by a spring. This causes the hammer, *H*, of the igniter to be suddenly moved away from the anvil, *A*, thus breaking the contact between the points and making a large, flaming spark. The whole igniter mechanism fits in a plate, *P*, having a ground tapered seat, and which is attached to the inlet chamber by three nuts. Besides this, the insulated pole, or anvil, is made up of a separate mica plug, *C*, having a tapered steel sleeve, *B*, which fits in a tapered hole in the plate and makes a gas-tight joint. *B* is provided with a thread, *s*, that carries a large clamping nut. Washer, *w*, and nut, *n*, clamp together the mica washers that make up the core, *C*. The iridium points are set into the small arms of the anvil, *A*, and the hammer, *H*, through tapered holes in the ends of these parts. The points are then brazed into place, and the holes behind them are filled. Loss of the points is therefore impossible, and the wear upon them is so slight that each set will easily last for 10,000 miles. In the photo of the engine *a* is an insulated handle that operates a small knife switch and cuts out the igniter. These are fitted to all four igniters and are used for the purpose of testing. The four caps, *o*, seen over the inlet valves, are for the purpose of allowing these valves to be removed, if it is necessary to grind them at any time. The valve springs are attached to the valves by passing through holes in the latter. The same arrangements are duplicated on the exhaust side of the motor. The gear-driven magneto is seen at *M*, the carbureter at *C*, the auxiliary piston air valve (which has a special type of very sensitive coiled spring) at *A*, and the inlet pipes to the cylinders at *B*. At *d* is the pivot which connects the rod that runs forward from the piston throttle valve of the carbureter to the lever arm of the governor. By pressing on the accelerator pedal, *X*, the driver can throw the governor out of action. The fan belt is shown at *e*. *O* shows a number of oil pipes that come up from the oiler (placed below the footboard and driven by a wire belt) and connect with a row of sight feeds on the dash, whence they lead to the crankcase of the engine and other points that need oiling.

The magneto used on this car is made by the manufacturers of the latter. The magnets employed in its construction are of the very best quality obtainable, and will hold their magnetism for a very long time. All the working parts of the magneto are thoroughly protected.

The 20- and 35-horse-power models which the Locomobile Company is building this year, both have a final individual chain drive, and are fitted with Hess-Bright ball bearings in the wheels and transmission. All the features of a high-class car, such as pressed-steel frame, alloy steel in shafts, gears, and many other important parts, are found in the 1907 Locomobile touring car. The general appearance of this machine can be noted from the photograph reproduced on page *33*.



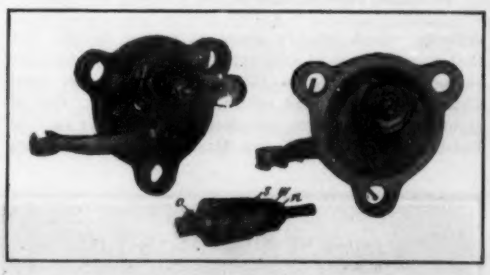
WATER-COOLED ROTARY VALVE APPLIED TO A 3-CYLINDER DURYEA ENGINE.

A. Inlet port from carbureter. *B*. Cut-away part of valve. *C*. Cylinder. *E*. Exhaust port. *J*. Water jacket around valve. *P*. Inlet port of cylinder. *V*. Rotary valve. *W*. Hole in valve for water. *S*. Spark-plug hole.

AN AUTOMOBILE MOTOR WITH ROTARY VALVE.

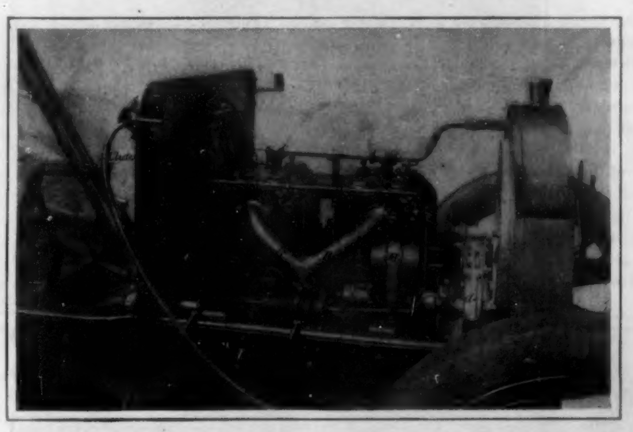
The Duryea Power Company exhibited for the first time, at the recent show in the Grand Central Palace, a decided innovation in the form of a rotary-valve triple-cylinder engine. Mr. Charles E. Duryea has been experimenting with this device as opportunity permitted for the last four years, and has been marketing it regularly to a limited extent during the past season. His experience with it thus far has been so satisfactory that he intends to push its manufacture more vigorously hereafter. This valve, as can be seen from the drawing, consists of a single revolving shaft having three

(*Continued on page 52.*)



MAKE-AND-BREAK IGNITER OF THE LOCOMOBILE ENGINE.

A. Anvil. *B*. Tapered sleeve surrounding mica insulating core, *C*. *D*. Connector from insulated pole to knife switch. *H*. Hammer of movable electrode. *L*. Lever for operating hammer. *P*. Plate carrying complete igniter. *o*. Iridium point set into anvil, *A*. *s*. Thread on sleeve *B* for large nut. *w*, *n*. Clamping washer and nut for core, *C*.



FRONT END OF CHASSIS OF LOCOMOBILE 35-HORSE-POWER TOURING CAR.

A. Auxiliary air valve of carbureter. *B*. Inlet pipe. *C*. Carbureter. *M*. Magneto. *O*. Oil pipes. *X*. Accelerator push pedal. *a*. Knife switch for igniter. *b*. Make-and-break igniter. *c*. Igniter operating rod. *d*. Governor lever arm connection to throttle. *e*. Fan belt. *o*. Valve cap.

ENGINE OF THE 60-HORSE-POWER THOMAS CAR.

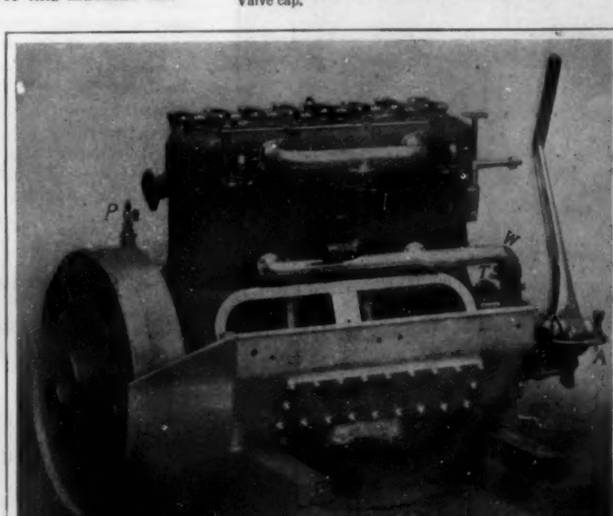
Progressive manufacturers have sought to improve their cars for this year not only by using the best materials, but also by doing away with all features which experience has shown are liable to break down, give out, or otherwise cause trouble. Water circulating pumps have been gear-driven instead of chain-driven for some time past, and now the tendency is to do away with all belts whatsoever. This tendency is illustrated well in the accompanying photographs of the Thomas engine, which show a fan driven by bevel gears, a spiral spring (not shown) being interposed in the drive. On the opposite side of the engine is a gear-driven, high-tension magneto, while the shaft seen at the bottom of the picture driving the gear water pump is extended back through the dash (the extension having two universal joints) and used to drive a new spark generator (Atwater-Kent device) consisting of a spark coil with mechanically-operated contact arrangement and secondary distributor, which draws its current supply from four dry batteries. This contact produces a single spark only, while the contact is so very short that an almost infinitesimal current flows each time and, as a consequence, one set of dry batteries will run a 4-cylinder car from 2,500 to 3,000 miles. A special button on the containing case makes it possible to jump a spark in the cylinder that is on compression and thus, oftentimes, to start the motor from the seat. The magneto is used as the regular ignition supply, while the device just described serves as a reserve.

The lubricator, also, is driven by bevel gears. Its horizontal shaft projects through the dashboard, and a vertical shaft rises up from the engine base to drive it. There is no commutator or timer on the car, as both the magneto and generator mentioned are gear-driven and properly set.

THE 50-HORSE-POWER NORTHERN ENGINE.

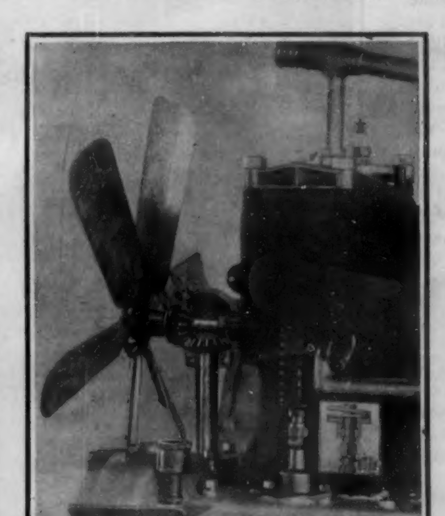
The Northern 50-horse-power 5 x 5½-inch, 4-cylinder engine is a solitary example of an engine having cylinders and upper half of crank case formed of one integral casting. Another novelty about this engine is that the water jackets are galvanized, thus preventing rusting. The valves are arranged in a row in the cylinder heads and are operated by tappets and push rods from a single camshaft. This camshaft is provided at its rear end with a crank for operating the piston of an air pump the top of which is provided with a valve, seen at *P*. A connection can be made here for blowing up the tires, though the prime purpose of the pump is to provide air at 50 pounds pressure for operating the clutch and band brakes on the rear wheels. This compressed air, reduced to 2 pounds pressure, also forces gasoline from the tank to the carbureter. The air for the clutch is led through a curved pipe, *A*, into the hollow crankshaft at its forward end, and passes through the latter to the clutch (seen in the flywheel) where it presses together a floating leather disk and another attached to the flywheel, clamping between them a steel disk on a stub shaft attached to the propeller shaft through a universal joint. The power is applied to the wheels through a 3-speed transmission located at the rear axle. The bottom half of the crankcase is an aluminum casting with flaring sides that abut against the sides of the frame and are bolted to them. This casting contains an oil reservoir with inlets to the crank case controlled by a float-operated valve which is depended upon to automatically maintain the proper oil level in the case. The lubrication is entirely by splash. The upper crank case has large hand holes through which the bearings can be readily adjusted. By extending the lower crank case to the frame, Mr. Charles B. King, the designer of the Northern car, has completely closed in the engine without using a sep

(*Continued on page 53.*)



THE 50-HORSE-POWER 5 X 5½-INCH ENGINE OF THE NORTHERN TOURING CAR.

Note the air-operated clutch inclosed in the flywheel and the lever starting device used in place of a crank.



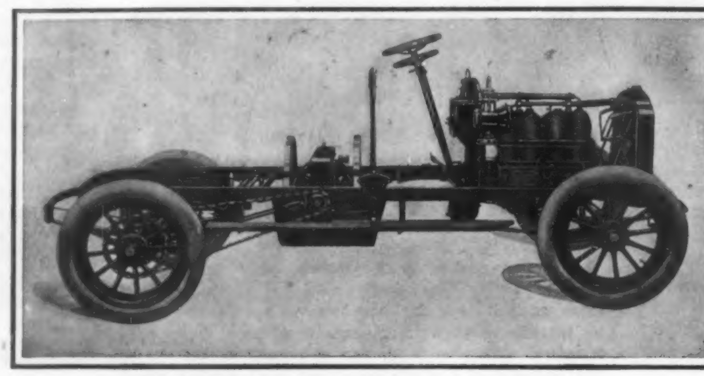
FRONT END OF THOMAS ENGINE, SHOWING BEVEL-GEAR-DRIVEN FAN.

The small sectional drawing shows method of securing valve-spring washer in place on stem by a split ring fitting into a groove on the valve stem. This simple device makes the valve spring instantly removable by prying up the washer.

FRICTION-DRIVE CARS

A NEW DOUBLE DISK TYPE OF FRICTION-DRIVE AUTOMOBILE.

In the view of the chassis shown herewith, upon close examination the reader will note the tops of two transverse disks that project upward at about the middle of the frame. These disks are on an extension of the engine crankshaft, and they not only act as flywheels, but also serve to transmit the power to two short countershafts, whence it is carried by chains to the rear wheels of the car. For this purpose each countershaft has slidably mounted upon it a smaller disk wheel. The short countershafts are pivoted so that, by the movement of a pedal, they can be brought in contact with, or separated from, the main driving disks. Normally, one of the small wheels comes in contact with one disk and the other with the second disk when the pedal is pushed forward. This rotates both small wheels in the same direction. The reverse is obtained by swinging the countershafts so that their respective wheels contact with the opposite disks. The wheels can be moved in unison toward or away from the center of the disks to obtain the variation in speed. This is accomplished by the second wheel seen below the steering wheel. No differential is required, as the differential movement is allowed for by the slip of the smaller steel wheels on the leather-faced disks. This machine is a variation of the usual friction drive arrangement, such as is described below. In doing away with the differential, the designer has hit upon a rather more complicated arrangement. This, however, has the advantage that there are no differential gears to wear or strip, while since the drive to each rear wheel is entirely separate, in case of accident to one side of the transmission the car can still be propelled by the other.



CHASSIS OF SIMPLICITY FRICTION-DRIVE AUTOMOBILE.

In tuis type of friction-drive car two large disks on the prolonged crankshaft drive two smaller wheels on two short transverse shafts that carry the driving sprockets.

THE HOLSMAN ROPE-DRIVE AUTOMOBILE.

By the use of wire-rope cables for transmitting the power from the countershaft to its large rear wheels, the Holsman automobile is put in the class of friction-driven machines. This buggy, with its large wood wheels and solid rubber tires, is the nearest approach to the horseless carriage type of automobile that has thus far been produced. Save for the fact that it is steered by the usual steering knuckles, instead of by swinging the entire front axle on a fifth wheel, the Holsman machine is in nearly every respect like a horse-drawn buggy. It is fitted with a double-opposed-cylinder engine of 4 inches bore and stroke, placed fore and aft beneath the body, and driving through two Morse silent chains a countershaft placed beneath. Either one of the two sprockets on the engine shaft can be engaged by means of a sliding feather, which is shifted by a small lever on the front part of the seat. Ordinarily, the starting and running can all be done on the high speed. This is accomplished by pulling back the long lever at the right of the driver, which throws forward the countershaft and tightens the ropes, thereby transmitting the power to the rear wheels. A differential is not necessary, as the ropes can slip without damage. These ropes are in reality special wire and rope cables, made of the strongest Manila rope and steel wire. Besides giving a silent drive, their life is considerable. The reverse is obtained by a forward movement of the hand lever, which causes two small grooved wheels on each end of the countershaft to come in contact with the rubber tires on the rear wheels, thus driving the vehicle backward at a slow speed. On account of its large wheels and solid rubber tires, the vehicle runs and rides very easily. It is steered by a lever, and can be run at as high a speed as 30 miles an hour. The motor and the body are mounted on two long side springs, which absorb all the shocks from the road.

That this machine, as well as the larger four-passenger one built by the same firm, is quite practical upon ordinary rough country roads, is proven by the fact that one machine of each type won first place in their respective classes in a 105-mile reliability run from Chicago to Aurora and return, held last July. Out of eighty-four cars which completed the run, the smaller Holsman machine and two Maxwell runabouts made perfect scores; while the larger Holsman car (which, however, was fitted with the same engine) was penalized only 14 points, as against 151 of its nearest competitor. The small photograph in the corner of the larger cut shows the advantage of large wheels upon snow-covered roads. A machine of this type can traverse deep snow without any very great difficulty. It will likewise not be found wanting on muddy or rocky roads; and owing to its being equipped with solid tires, which of necessity precludes any tire trouble, it is a great favorite with physicians and other men requiring a machine of extreme reliability.

THE HOLSMAN AUTOMOBILE WITH WIRE-ROPE DRIVE.

This machine is one of the most successful of the "horseless carriage" type. It is propelled by a double-opposed-cylinder air-cooled motor having two different speed reductions to the countershaft.

A SUCCESSFUL FRICTION-DRIVE AUTOMOBILE.

For several years past the friction disk form of variable-speed transmission has been experimented with and used with satisfactory results by a number of western manufacturers. Perhaps the most successful, at any rate the most up-to-date, application of this form of transmission is that found in the Lambert car built by the Buckeye Manufacturing Company, of Anderson, Ind. Combined with an extremely simple propeller shaft and bevel gear drive, and deriving power from a 40-horse power motor, this transmission offers many advantages, chief of which are simplicity and lack of expensive up-keep.

The Lambert touring car has the general appearance of any high-grade 4-cylinder automobile. The large view of the transmission printed below shows practically all the working parts of the car. A very large motor flywheel faced with aluminium (*F* in the illustration) is made to serve as the driving disk, while a large spoked wheel, *W*, having a ring of compressed paper, *X*, bolted to its periphery, acts as the driven. This latter wheel can be slid on its shaft across the face of the driving disk. On one side the reverse is obtained, while when it is slid to the other side of the flywheel, the forward speeds can be had. The lever, *L*, which moves over a quadrant whose notches correspond to the different speeds, operates the long, curved, shifting lever, *S*, by means of the smaller lever, *M*, and the connection, *N*. By sliding the wheel, *W*, from the center to the outside of the flywheel, *F*, any speed from a crawl to 45 miles an hour can be obtained with the motor working at full power. After the wheel, *W*, has been slid to the proper place, it is brought against *F* by a push on pedal *Y*. This pedal, through a connecting link, *A*, and lever, *B*, turns the hollow shaft, *C*, which has at each end short levers connected by links, *D E*, to the pivoted bearings, *G H*, of the transverse shaft. The result is that the whole shaft is moved bodily forward and *W* is pressed against *F*. The pedal is held where set by means of a locking spring, *I*, that travels over a notched track. By pushing on the upper edge of the pedal, the locking spring is released and the pedal, and consequently the transverse shaft, are both drawn back by a spring. This pedal corresponds to the clutch pedal of any ordinary car, but it is exactly opposite in its action. The pedal, *Z*, operates an expanding brake in drum, *D'*, on the transverse shaft, and is interlocked so as to break the contact between *F* and *W* when it is applied. The outer hand lever works, through an equalizer on the differential casing, two expanding brakes in the hubs of the rear wheels.

The new model Lambert car has the shaft drive shown herewith. By employing bevel gears at each end of the propeller shaft, no universal joints are needed, as the up-and-down movement is allowed for by the bevel gears and any slight forward thrust that might occur is withstood by two tubular radius rods, *R R*. As universal joints are dispensed with, the driving shaft can be completely incased in a tube, *K*. Miter gears are used within the case, *J*, instead of the ordinary bevels that are used at the other end of the driving shaft. A bevel gear differential and divided rear axle are employed. The motor is a $4\frac{1}{2} \times 5$ 4-cylinder Ru

(Continued on page 53.)

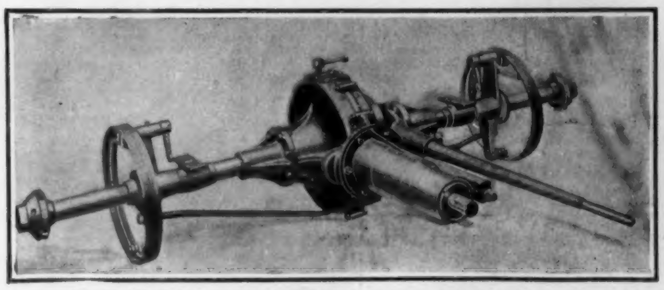
THE LAMBERT FRICTION DISK TRANSMISSION AND SHAFT DRIVE WITHOUT UNIVERSAL JOINTS.

A, B, C, D, E. Levers, sleeve and connections for pushing disks in contact. *D'*. Band brake. *F*. Flywheel disk. *G, H*. Bearings of countershaft. *J, K*. Bevel gear and propeller shaft housing. *L*. Disk-shifting lever for changing speeds. *M, N, S*. Connections and curved lever for shifting wheel, *W*. *O*. Muffler. *R, R*. Radius rods. *P, T*. Timer and connection for shifting same. *V*. Steering column. *Y, I*. Clutch pedal and locking spring. *Z*. Brake pedal.

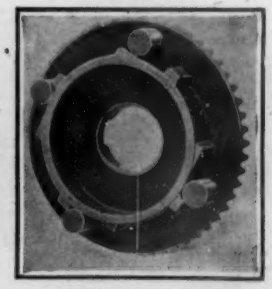
TRANSMISSIONS

A NOVEL TWO-SPEED, DIRECT-DRIVE TRANSMISSION GEAR.

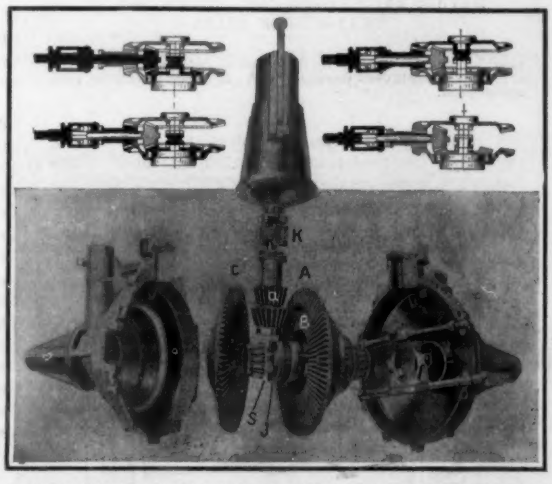
A new form of two-speed-and-reverse transmission, in which the high and low speeds are obtained by a double set of bevel gears, is shown in the illustration in the center. This transmission is adapted to be used as a countershaft or on the rear axle, and it is combined with the usual differential that is used in either of these two places. There are two large bevel gears, *A B*, one placed inside the other, located upon the same shaft as the differential and directly alongside of it. Opposite these gears is another large bevel gear, *C*, intended to be used for the reverse. This large gear, as well as the smaller gear opposite it, can be locked to the central squared sleeve by means of a jaw clutch, *J*. This sleeve is attached to the casing of the differential, and the latter is driven by means of it. Another double jaw clutch, *K*, can be slid so as to lock either of the two pinions to the driving shaft. The back of the smaller, or high-speed, bevel gear, *B*, is finished off with a ring having wedge-shaped projections on it, as shown in the small cut. Four rollers are placed on these projections, and are adapted to wedge between a projecting ring of outer gear, *A*, and that of gear, *B*, when power is transmitted to the former. Thus the drive is continued through the inner gear and squared sleeve, *S*, to the differential. Should the car be running on the high gear, and the low gear be then thrown in, the center and smaller bevel gear will keep on rotating at the speed given it by the movement forward of the car; and not until the larger bevel gear, *A*, attains the speed of the smaller one, and catches up with it, so to speak, will the rollers jam and the drive be taken up by *A*. On account of this arrangement the operator can shift the clutch, *K*, so as to drive through the outer pinion while the car is running along on the high speed, and this can be done without the subsequent jerk and strain on the transmission which would occur if this is done with the usual type of planetary gear. To obtain the reverse, it is necessary to shift the jaw clutch, *J*, so as to engage the other large bevel, *C*, and then to clutch the pinion, *a*, to the driving shaft. If the car is running on the low speed, the reverse can be thrown in without releasing the clutch, though this is hardly advisable. The change can be made from low to high, however, simply by throwing the jaw clutch, *K*. This transmission, although apparently somewhat complicated, is in reality fairly simple, and a decided improvement over the usual form of two-speed planetary gear. When assembled on a rear axle or countershaft, it has a very neat appearance. The four line cuts show the settings of the different parts in the four positions to which they can be moved. The transmission is very substantially built, and it is an exceedingly efficient one, as there is but a single reduction through bevel gears.



PLEUKHARP TWO-SPEED TRANSMISSION ASSEMBLED ON A REAR AXLE.



ROLLER RATCHET CLUTCH ON BACK OF SMALL BEVEL GEAR.



TRANSMISSION TAKEN APART. THE LINE CUTS SHOW GEARS AND CLUTCHES IN ACTION ON THE DIFFERENT SPEEDS.

High speed. Reverse.
Low speed. Neutral.

A NEW FORM OF TWO-SPEED TRANSMISSION COMBINED WITH THE DIFFERENTIAL.

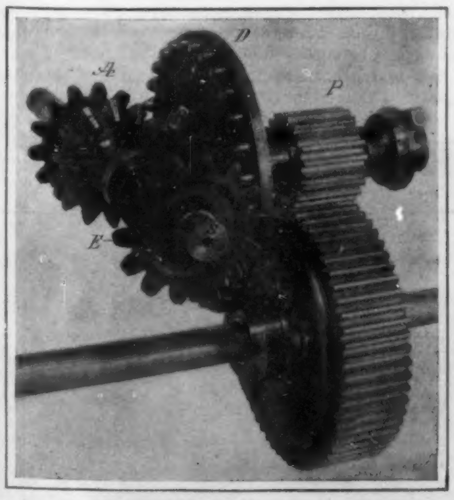
On most light-weight automobiles, such as runabouts and very light touring cars, a two-speed transmission is found adequate, as probably ninety-five per cent of the running is done on the high speed. On most of these cars the only available kind of transmission gear heretofore has been the well-known planetary type.

Where this transmission was used with a shaft drive, it was somewhat less efficient than where a direct drive with a chain was employed, but the reason of this was that bevel gears were employed on the rear axle, and not that the transmission itself was inefficient. On the high speed, as is well known, with the planetary type of transmission, all parts of the gear are locked together in a single piece, and there is a positively direct drive from the motor to the rear axle. With the new type of transmission shown herewith, this is still the case. At the rear axle, however, there is a speed reduction through a spur gear and pinion that is not had with the ordinary bevel-gear drive.

On the shaft that carries the spur pinion, *P*, there is a large disk, *D*, having cone-shaped pin teeth, and in the center of this disk is a bevel gear, *B*. This gear meshes with another bevel, *C*, of the same size, which is loosely mounted on the projection in the gear case of the propeller shaft, *S*, and which can be locked to this shaft by one side of a double jaw clutch. When the jaw clutch is moved out of engagement with the bevel gear, the other side of it engages with teeth in the small pinion, *A*, that meshes with the pins in the periphery of the disk, *D*. This pinion then drives the disk and its spur pinion at a reduced speed, and thus the low speed is obtained. The reverse is had by locking the other pinion, *E*, to the shaft, *S*, by means of another jaw clutch. Thus this combination gives two speeds forward and the reverse in an exceedingly simple manner, and with practically no more loss of power than is had in the usual bevel-gear drive. As the propeller shaft can be made to extend forward to the engine in a practically straight line, there is very little loss of power in the universal joints, due to their angularity. The loss of power in the spur-gear transmission is said to be not over three per cent, while owing to the conditions just mentioned, the loss in the propeller shaft and bevel gears is not as great as it is with the ordinary car. The transmission is practically noiseless on the low and reverse speeds, and when running on the low speed or with the car standing stationary there is not that grinding noise that is heard with many of the planetary transmissions, no gears being in motion in the latter case. The combined transmission and differential is easily accessible, as large inspection plates on the top are provided. As it is placed above the axle, the road clearance is as great or greater than that usually obtained. This transmission appears to be one of the neatest and simplest two-speed gears that have thus far been placed upon the market. It is used on the Logan and Marion runabouts, and other makers will doubtless adopt it.

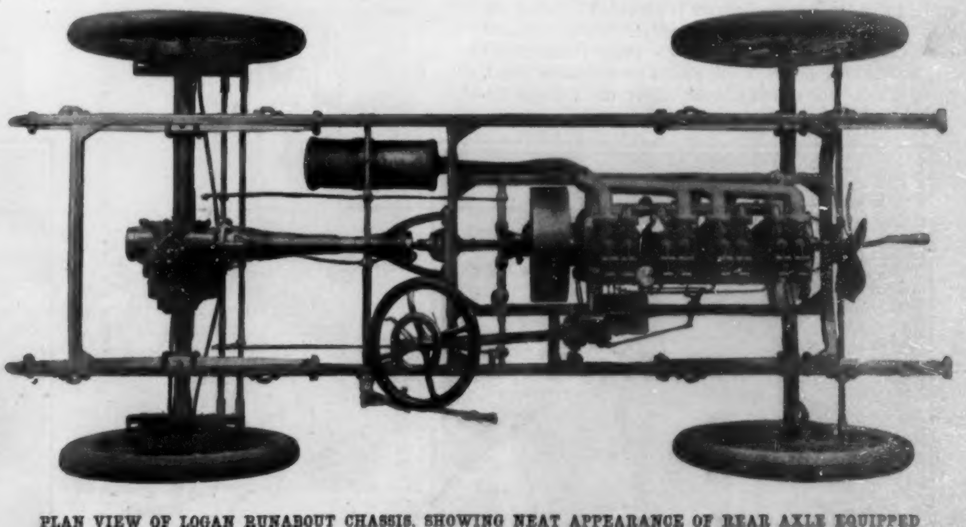
A TRANSMISSION WITH INDIVIDUAL JAW CLUTCHES.

Still another type of transmission giving three speeds and a reverse is that used on the new Deere-Clark car, in which sliding jaw clutches replace the sliding gears. As a result of this construction, the gears are always in mesh. They are locked to the shaft by two double jaw clutches, either one of which may be slid to engage the proper gear, by means of a suitable lever working in the usual H-shaped slot. Each clutch is provided with sixteen strong teeth, and as all engage at once, there is less chance of stripping than where the strain comes on only two or three teeth. Besides this, the main clutch in the engine flywheel is interlocked with the jaw clutches, so that the latter can not be slipped in except when the former is out. The one sliding gear in this transmission—the reverse pinion—can be thrown in instantly by pulling the lever straight back from the high-speed position. This makes it easy to stop quickly in case of emergency, which is very desirable, and not easily accomplished with the usual sliding gear. The shafts of this transmission run on Timkin roller bearings. A good idea of its construction can be had from the cut on page 47.



A NEW TYPE OF COMBINED TRANSMISSION AND DIFFERENTIAL.

A. Low speed driving pinion. *B*, *C*. Bevel gears for high speed. *D*. Disk with pin teeth for low speed and reverse. *P*. Spur pinion driving differential. *S*. Longitudinal driving shaft from clutch in flywheel.



PLAN VIEW OF LOGAN RUNABOUT CHASSIS, SHOWING NEAT APPEARANCE OF REAR AXLE EQUIPPED WITH HASSLER TRANSMISSION.

A novelty on this car is the small wheel within the steering wheel for controlling the speed-change mechanism of the transmission.

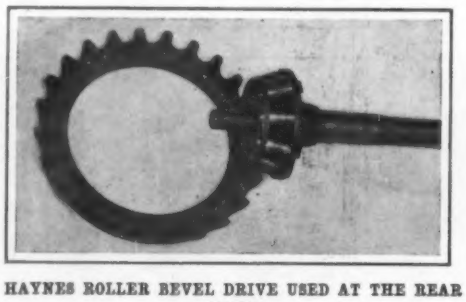
THE HAYNES TRANSMISSION AND ROLLER BEVEL DRIVE.

Two of the distinctive features of the Haynes cars are illustrated herewith. These are the roller bevel drive, which replaces the usual bevel gears at the rear axle; and the use of pawls and ratchet teeth for transmitting the power received by the master gear of the transmission to the hub of this gear, thereby allowing it to revolve idly when not in use, as when the car is running on the high speed, for example, or when it is coasting on the intermediate, and the other gears on the main and lay shafts are in mesh. As a general rule, if the gears are shifted back to intermediate while the car is running at a good speed, there is usually a terrific grating noise and the chauffeur is lucky if he does not strip a gear. The reason of this is that as the two intermediate gears attempt to mesh, they are revolving at a very rapid rate and are being driven one by the rear wheels of the car, and the other by the momentum of the clutch. Under these conditions it is well nigh impossible to mesh the intermediate or low-speed gears at all, or at least to accomplish this without damaging them. The Haynes ratchet device obviates this trouble by freeing the low and intermediate gears on the lay shaft, and allowing them to run ahead of the clutch shaft gear when the change is made from high to intermediate or low. Therefore, when these gears are meshed with those on the main shaft under the conditions stated, since they are at rest and have no inertia, no noise or damage can result. The gears can be shifted back without throwing out the clutch.

The other distinctive Haynes feature is the roller bevel drive. Instead of the usual large bevel gear on the differential, a large sprocket having specially-shaped teeth is used, while the bevel pinion is replaced by one having hardened and ground steel rollers set at an angle to match the teeth on the large ring. So efficient is this form of drive, on account of doing away with side thrust and also because of the diminished friction, due to the use of rollers, that tests of chassis have shown a loss of but 7 to 8 per cent in transmitting the power from the motor to the rear wheels. The cars upon which these improvements are used are of first-class construction throughout. That the material in them is good is evidenced by the fact that the racer which did so well in the last Vanderbilt race was a regular stock chassis equipped with a 50-horse-power engine. After demonstrating what his car could do in so severe a test, Mr. Haynes is engaged in constructing a considerable number of these high-powered machines in addition to his regular 30-horse-power model during this year.

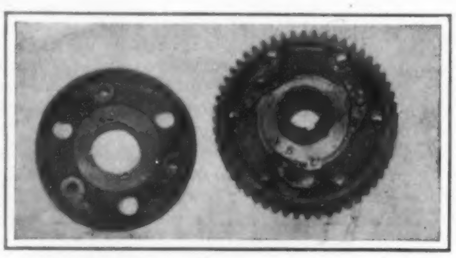
TRANSMISSION GEAR WITH DOUBLE CLUTCHES.

It is a well-known fact that on account of its large size and heavy weight, the usual cone clutch employed on automobiles has sufficient momentum, when it is thrown out, to spin around for some seconds and keep the gears in the transmission revolving at a considerable speed. When passing from a low speed to a high speed there is not so much danger of stripping gears as when the gears are changed in the opposite direction. Nevertheless, the beginner often experiences difficulty in speeding up his car, and before he knows it frequently starts to strip a gear, the result being that shortly after a number of the gears require renewal. An improvement noted on the new Thomas machine is the brake applied on the hub of the clutch when the latter is thrown out. This brings the clutch and gears to a reduced speed, although they still revolve at the speed at which the movement of the car forward drives them. A still greater improvement, which is also of American origin, is shown in the diagram, in which a second clutch is provided between the gear box proper and the differential. This clutch, *B* (see diagram), is in a separate compartment, and has its shifting lever, *D*, connected to the same pedal, *E*, to which the shifting lever, *C*, of the regular flywheel clutch, *A*, is linked. Thus when the pedal is depressed both clutches are thrown out, and brakes (not shown) are applied to the hubs, *V V'*, of the clutches, thereby bringing them and the gears immediately to rest. The gears can then be changed without any noise and without any danger of stripping. A



HAYNES ROLLER BEVEL DRIVE USED AT THE REAR AXLE.

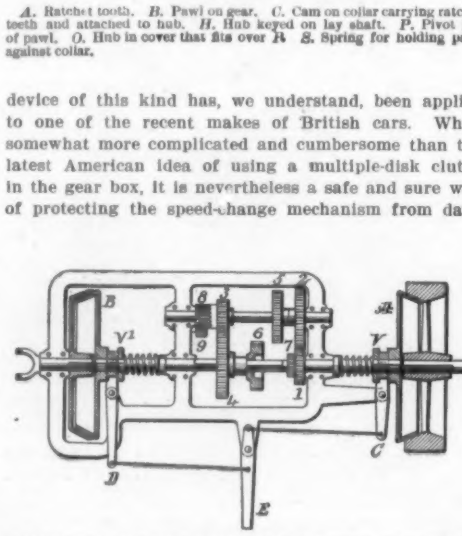
This form of drive does away with side thrust and is very efficient.



HAYNES RATCHET-AND-PAWL CONNECTION IN TRANSMISSION GEARS.

A. Ratchet tooth. *B*. Pawl on gear. *C*. Cam on collar carrying ratchet teeth and attached to hub. *H*. Hub keyed on lay shaft. *P*. Pivot pin of pawl. *O*. Hub in cover that fits over *H*. *S*. Spring for holding pawl against collar.

device of this kind has, we understand, been applied to one of the recent makes of British cars. While somewhat more complicated and cumbersome than the latest American idea of using a multiple-disk clutch in the gear box, it is nevertheless a safe and sure way of protecting the speed-change mechanism from dam-



IMPROVED TRANSMISSION WITH DOUBLE CLUTCHES.

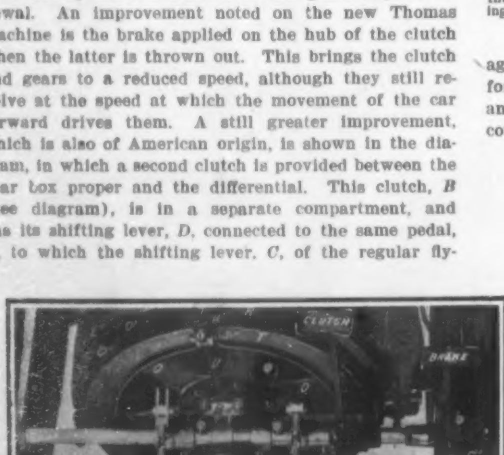
A. Regular flywheel clutch. *B*. Extra clutch between gears and propeller shaft. *C*. *D*. Operating levers. *E*. Clutch pedal. *V*, *V'*. Location of brake shoes for clutches. Gears are on low speed through *1, 2, 3, 4*. Intermediate speed is through *1, 2, 5, 6*. High speed is direct drive, 6 locking with *7*. Reverse is through *1, 2, 8, 9, 4*.

age where the cone type of clutch is used. The latest forms of multiple-disk clutch are, as a rule, so light and of such small diameter that the driving gears come to rest almost as soon as the clutch is thrown out. The use of a second clutch, however, assures their shifting without damage.

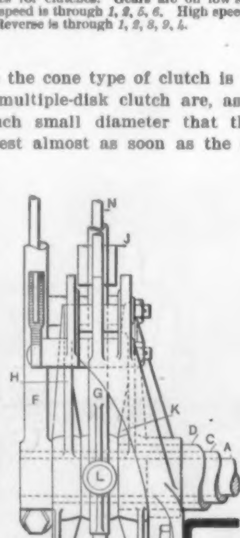
NOVEL CLUTCH AND TRANSMISSION FEATURES OF 1907 CARS.

The Thomas clutch, which is of the three-ring metallic type, is shown in one of the illustrations, as is also the interlocking arrangement, which makes it impossible to shift the gears until after the clutch has been withdrawn. The central clutch ring, *R*, of manganese bronze, is attached to the main shaft extending forward from the transmission. It has sixteen cork inserts that extend out 1/32 of an inch beyond its face and form much of the friction surface. The clamping disks, *O*, *O'*, are of gray iron and are attached to the flywheel by four studs that terminate in caps hollowed out to receive the ends, *U'*, of the levers, *U*, which are pivoted on pins, *W*, carried in lugs in an outer ring, *T*. The large coiled spring shown presses against the levers, *U*, and causes their tips, *U'*, to bear upon adjustable screws, *a*, in the ends of the hollowed caps, the result being that the fulcrums, *W*, of the levers, *U*, are forced toward the flywheel and the rings, *T O*, clamp the ring, *R*, between themselves and *O'*, which is attached to the flywheel by screws. A novelty is a brake shoe, *B*, that is applied to the clutch collar when the clutch is withdrawn, and which checks the rotation of the latter caused by the momentum of a rather heavy ring.

Another point about this clutch is that the pressure of the compressing spring is exerted through the levers upon the peripheries of the clutch disks, where the friction surface is greatest. This makes it impossible for the disks to become sprung or fail to take hold. The clutch is interlocked with the gears in such a manner that it is impossible to change gears without first throwing it out. This is accomplished by means of a short lever, fastened on the same transverse shaft that carries the clutch pedal and clutch shifter (the two arms of which are seen at *I I*). This lever, as it moves forward with the pedal lever when the clutch is thrown out, withdraws from engagement with the two notched sectors, *S S'*, the plunger, *P*. When this plunger is in engagement with these sectors, the gears are effectually locked. The sectors are on two hollow sleeves, one within the other, that extend to the gear-shift lever on the outside of the frame. Should the gears not be completely in mesh, the plunger, *P*, cannot slip back into place, and, consequently, the clutch cannot be thrown in. This arrangement, therefore, makes it well-nigh impossible to damage the gears. These are of wide face and large diameter, the face and pitch being respectively 1 3-16 inches and 8. Ball bearings are used throughout the transmission with the exception of that at the forward end of the main shaft, which is a Hyatt roller bearing. Annular ball bearings are also used on the differential and the sprockets. The transmission and differential are in a single case, which is suspended from three points on cross members of the frame. The gear-shifting system is altogether new. It is easy of operation and practically fool-proof. By referring to the diagram of the gear-shift lever, the reader can see how this mechanism works. The two sleeves which carry the sectors, *S S'*, are shown in the diagram at *C* and *D*, while the emergency brake shaft, which extends across the car inside of a smaller sleeve, is shown at *A*. This shaft carries a lever, *F*, upon its outer end. The two sleeves, *C* and *D*, have fastened to them vertical levers, *H* and *K*, respectively, and these levers have at their upper ends notches to receive the latch *J*, when the gear shift lever, *N*, is moved to one side or the other through the gate of the H-shaped plate that is usually employed in a four-speed selective transmission. When moved sideways, the lever, *G*, turns upon suitable pivots, *L*, while when moved forward and backward it rotates around sleeve, *C*. The bottom part of this lever consists of a curved sector, which engages in a slot in pin, *M*. This pin sets in two eyes

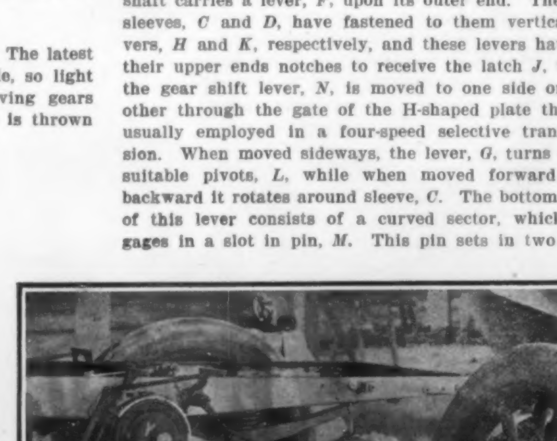


THREE-DISK METALLIC CLUTCH AND INTERLOCKING MECHANISM OF THOMAS CAR.



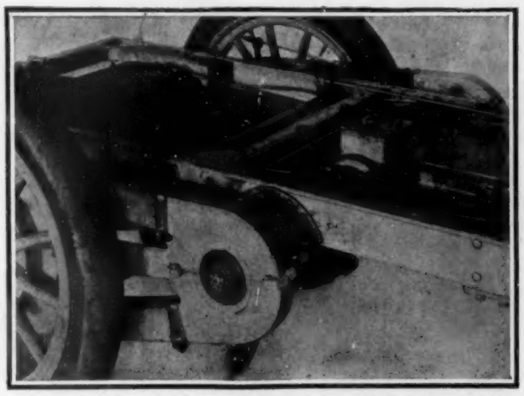
INTERLOCKING GEAR-SHIFT LEVER.

B. Chassis frame. *E*. Bracket.



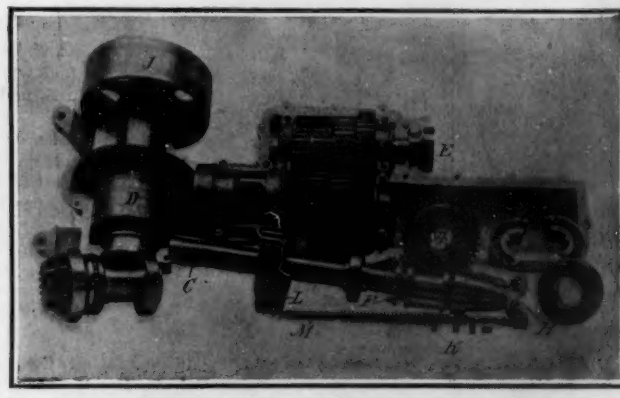
RADIUS ROD, BRAKES, AND REAR WHEEL OF 60-HORSE-POWER THOMAS CAR.

in the bottom ends of the levers, *H* and *K*. In the position shown it effectually locks these levers, and holds the gears in the neutral position. When it is desired to insert a gear in mesh, the operator first moves lever, *G*, to one side or the other of the H-shaped quadrant, and thereby releases at the bottom the lever that its latch, *J*, engages at the top. As soon as the clutch is thrown out the driver can then move *G* forward or backward in its slot until he has in mesh the gear desired. To bring into play the other gear set he must, after releasing the clutch, slip the lever, *G*, through the gate, or opening in the H-shaped quadrant, and thereby cause the latch, *J*, to lock into the other short lever, *H*, which is at the same time automatically released by the pin, *M*, while its twin is locked. Thus, it will be seen that there is a double interlock on this car, a fact which should make it extremely difficult for the novice to get into trouble while shifting the gears. The rear axle and countershaft construction is shown in one of the photographs. As already stated, the countershaft revolves on Hess-Bright ball bearings, and these are placed in the drum, *Y*, directly beneath the driving sprocket, which is attached on the six studs shown. The brakes are both of the contracting type, the foot brakes being applied upon drums which carry the driving sprockets, as can be plainly seen, while the emergency brakes, worked by the lever, *F*, are applied upon sprocket drums on the rear wheels. These drums are internally notched with ratchet teeth, and the pawl, *Z*, can be dropped into engagement with them to stop the car from running backward down hill. Last year this device was applied in a similar manner, except that the ratchet teeth were external instead of internal. The reverse is interlocked with the pawls, so that these cannot be engaged when the car is being backed. Perfectly straight, drop-forged radius rods, the rear ends of which completely encircle the rear axle, are employed on the new model Thomas cars. The construction is very substantial, and the car is one of the best-arranged machines used with a final chain drive.



PROTECTIVE CHAIN CASING ON THE LOZIER TOURING CAR.

This is one of the much-needed improvements on cars employing the double chain drive. The countershaft of this car is also fitted with a separate water-cooled band brake near each end.



THE BERKSHIRE INDIVIDUAL CLUTCH TRANSMISSION.

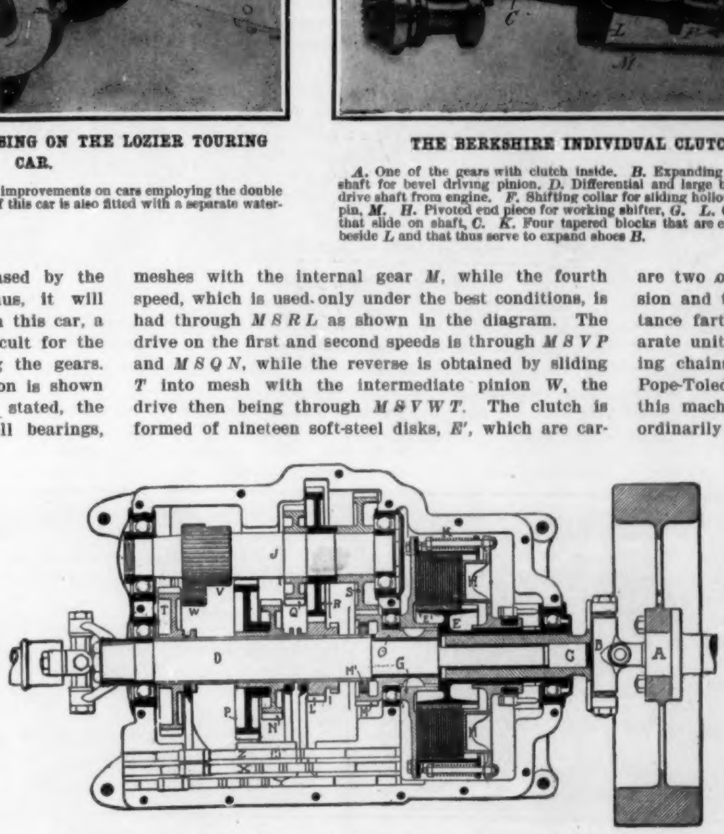
A. One of the gears with clutch inside. *B*. Expanding clutch shoes. *C*. Keys on hollow shaft for bevel driving pinion. *D*. Differential and large bevel gear. *E*. Universal joint for drive shaft from engine. *F*. Shifting collar for sliding hollow shaft, *C*. *G*. Shifter for tapered pin, *M*. *H*. Pivoted end piece for working shifter, *G*. *L*. One of the four gears with clutches that slide on shaft, *C*. *K*. Four tapered blocks that are expanded by *M* through holes seen beside *L* and that thus serve to expand shoes *B*.

THE LOZIER PROTECTED DRIVE CHAIN.

One of the great disadvantages of the double side-chain drive over the drive by propeller shaft and bevel gears, is that in the former case the chains are near the wheels, where mud and dirt can splash upon them, and where, as a rule, no protection is given them. An improvement on the 1907 40-horse-power Lozier touring car is shown herewith. This consists in the protective casing for each chain, which completely incloses it and keeps off both dust and mud. The casing is composed of two aluminium castings, which surround the sprocket on the countershaft and the sprocket on the wheel respectively. These two castings are connected by a straight central supporting member of rectangular cross section, while rubber tubing (also rectangular in cross section) surrounds the chain, and connects the aluminium castings at the top and bottom. These rubber connections are clamped to the castings in such a way as to make a tight joint. Being flexible, they allow for any movement of the countershaft relative to the rear axle. The protection is very complete, and adds greatly to the life of the chain as well as to its quiet running. Another feature of this car is the fitting of separate brakes near each end of the countershaft, just inside of the frame. These brakes are connected to the pedal through an equalizing device, and they are water-cooled, being fitted with water jackets supplied from a special tank.

THE POPE-TOLEDO COMBINED CLUTCH AND TRANSMISSION.

The photograph and line drawing reproduced herewith give a good idea of the new combined clutch and transmission, which is used as a separate unit on the Pope-Toledo 40-horse-power touring car. All the gears and shafts are of chrome nickel steel, and every moving part is fitted with Hess-Bright ball bearings. Besides the carrying of the clutch in the forward part of the gear case, another feature of this transmission is that the direct drive is obtained upon the third speed by sliding gears *L I* to the right, so that *I* meshes with the internal gear *M*, while the fourth speed, which is used only under the best conditions, is had through *M S R L* as shown in the diagram. The drive on the first and second speeds is through *M S V P* and *M S Q N*, while the reverse is obtained by sliding *T* into mesh with the intermediate pinion *W*, the drive then being through *M S V W T*. The clutch is formed of nineteen soft-steel disks, *E'*, which are carried on the special carrier, *E*. This carrier is keyed to the hollow shaft that connects with the universal joint, *B*. Twenty hard-steel disks supported at their peripheries on another carrier, *G* (which terminates in the gear *M*), form the other part of the clutch. The first-mentioned disks are attached to their carrier, *E*, by means of six keys, arranged radially around the carrier. These disks are 10⅛ inches in diameter. The other disks, which are 10¾ inches in diameter, are attached to their carrier, *G*, by four series of slots placed 90 degrees apart around their peripheries, and through which pass bolts carrying spring washers between the disks, to assist in separating them when the clutch is disengaged. On the extreme outside of the disks are eight springs, *K*, placed radially at equal intervals. These act through the pressure plate, *H*, to press the disks together. By placing them on the outside of the disks, and causing them to work through this pressure plate, all the disks are compressed uniformly throughout their entire surface. Besides a universal joint, *B*, between the crankshaft, *A*, and the hollow stub shaft around *C*, there are two other universal joints between the transmission and the countershaft, which is located some distance farther back on the frame as an entirely separate unit. This makes it possible to use short driving chains, and is a distinctive feature of the new Pope-Toledo car. The entire power transmission of this machine is, therefore, quite different from that ordinarily used. The idea of incasing the clutch with the gears is a good one, as is also the plan of placing the countershaft as near the rear wheels as possible. The Pope-Toledo engine of 4⅞ bore by 5¼-inch stroke is rated at 40 horse-power. It is very similar to the De Luxe engine illustrated on page 34, as it has the same walking-beam valve mechanism, and the cylinders are cast in pairs and provided with copper water jackets. A peculiar arrangement is noted in the oiling of this engine, which is accomplished by pressure feed, from a small oil tank placed beneath the floor, and having a pressure of 5 pounds per square inch, supplied by a hand-operated air pump between the individual front seats. There is also a plunger for forcing oil directly into the crankcase. A convenience with regard to the carbureter is that it can be primed by pressing a button arranged beneath the radiator at the front of the car. The fuel is forced by air pressure from a double 25-gallon tank at the back of the car to a 5-gallon running tank on the dash, in which the gasoline is kept at a certain level automatically. Should it fall below this level, an alarm is sounded.



CROSS-SECTION OF POPE-TOLEDO COMBINED TRANSMISSION AND CLUTCH.

A. End of crankshaft carrying flywheel. *B*. Universal joint. *C*. Bearing of main transmission shaft, *D*, in hollow stub shaft that carries clutch disk drum, *E*. *E'*. Driving disks of clutch. *F*. Rear shaft extending to countershaft. *G*. Driven drum of clutch. *H*. Pressure plate of clutch. *I*, High-speed gear that fits in internal gear, *M'*. *J*. Lay shaft. *K*. Clutch springs. *O*. Sleeve carrying master pinion, *M*. *X*, *Y*, *Z*. Notched shifting-gear rods.

TRANSMISSION AND OPERATING LEVERS OF POPE-TOLEDO TOURING CAR.

The multiple-disk clutch is in a compartment at the front end of the gear box. The countershaft for the double chain drive is placed by itself some distance back of the gear box, thus allowing short chains to be used.

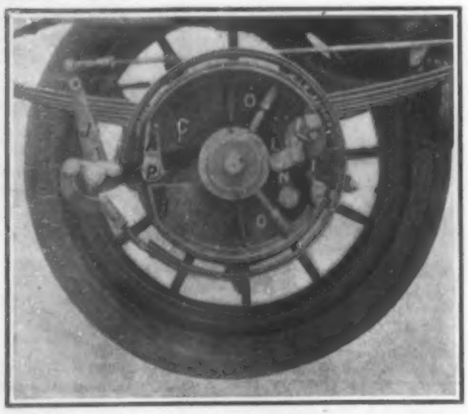
A NOVEL INDIVIDUAL CLUTCH TRANSMISSION.

The accompanying photograph shows the transmission of the Berkshire car taken apart to show the interior construction. The top half of the case is simply removed to show the interior. At one end of the top half of the case is a raised housing. Dependent from the inside of this housing are the shifting forks, which in turn are connected by a shaft to the operating lever on the side of the car. The shaft, *E*, is connected direct to the engine. Upon this shaft are keyed the steel gears which mesh into the phosphor bronze ring gears, *A*. Each of these ring gears are supplied with internal expanding frictions, the two halves of which are shown at *B*. These two halves are again shown placed in position at *A*. The sliding shaft, *C*, upon which this ring gear is placed moves longitudinally, when placed in position in the case, through all of these gears. At a point in this movable shaft, four square holes are made, which open into a hole drilled longitudinally through the entire length of the shaft. These holes are shown beside *L*. The steel wedge pins, *K*, are inserted in these square holes, and when located under any of the ring gears, are forced outward by the internal expanding wedge *M*, which is operated by a side lever on the car, in connection with the depending shifting forks, which are connected with *F* and *G*. The forward motion of the lever operates *F*, which is fast to the shaft and moves the shaft longitudinally under the desired gear. The backward movement of the lever operates forks connected with the tapered cone, *G*, and forces it under the fingers, *H*, which are fulcrumed on

(Continued on page 53.)

TYPICAL BRAKES ON 1907 CARS.

The accompanying photograph shows the double brakes used on the rear wheels of the new Cadillac touring car, which are typical of those used on many other 1907 models. As can be readily seen, there are both an internal expanding and an external contracting brake, each of which is lined with camel's hair felt, a material which has had much vogue of late for this purpose. The internal brake is made up of two semi-circular shoes, *A* and *B*, supported upon a pivot pin, *P*, that projects from the steel casting, *C*, forming one end of the rear axle tubing. These shoes are drawn together and away from the brake drum of the wheel by means of two coiled springs. The distance to which they are withdrawn is regulated by two pins with lock nuts, *O O*, which screw into sockets in the shoes and press against a central washer surrounding the axle. The lever arm, *N*, which operates the brake, is connected to the toggles, *I I*, by a link, *L*. When the shaft carrying this lever arm is rotated, the toggles are pressed apart and the shoes are expanded. This makes a very powerful emergency brake, and is operated by a hand lever. The outer contracting band is operated by a lever, *J*, which, when it is moved forward by the rod shown, pulls the two ends of the band together by means of the rocker attached to its shaft. This brake is connected to the pedal, and is the regular running brake. Both brakes are equalized, so that an equal pressure is exerted upon the drums of each wheel.



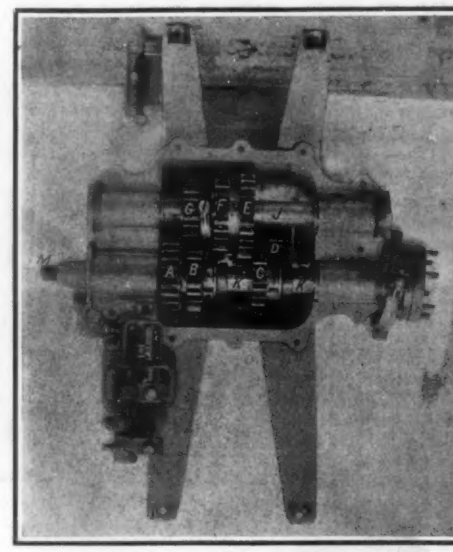
TYPICAL EXTERNAL AND INTERNAL HUB BRAKES USED ON CADILLAC CAR.

A, B. Expanding shoes lined with camel's hair felt. *C.* Supporting drum on end of stationary axle sleeve. *I, I.* Toggles for expanding shoes, *A, B.* *N. L.* Lever and links connecting with toggles. *O, O* Adjustable stop for limiting withdrawal of shoes by coiled springs. *J.* Lever for operating contracting band brake.

AN IMPROVED SLIDING-GEAR TRANSMISSION

The transmission used on the new 20-horse-power 4-cylinder Cadillac car is of the double sliding type, in which the gears on both the main and secondary shafts are made to slide. In the photograph the gears are on high speed, *A* and *B*, which are on the shafts *M* and *K* respectively (the latter shaft telescoping into the former within the gear *A*), being locked together by the usual type of jaw clutch. The two gears, *E* and *F*, are securely fastened to the shaft, *J*, while the gear, *G*, is made to slide upon it. To obtain the first and second speeds, gear, *G*, is slid to the left upon the squared portion of shaft, *J*, and gear, *C*, is brought into mesh with *E*, or gear, *B*, with *F*. As soon as the gears are moved to the high speed, *G* is automatically slipped out of mesh with *A*, and moved into the position shown.

In this position no gears on the secondary shaft, *J*, are running. To obtain the reverse, pinion, *C*, is brought into mesh with *D*, which carries upon its shaft another gear that meshes with *E*. This reverses the motion of the gears on the lay shaft, and also that of the driving shaft, *M*. The gears are shifted by means of a lever which operates through toothed sectors, to slide the gears by means of connections to the shifting forks. These connections are not shown in the photograph. Both shafts of the transmission are mounted upon Hyatt roller bearings. The design of this transmission is such as to facilitate the meshing of the gears without the usual crashing and grinding which takes place with many sliding gear transmissions. The gears are inclosed in a strong aluminium casing provided with an oil-tight cover, and having arms by which it is attached to the frame of the car.

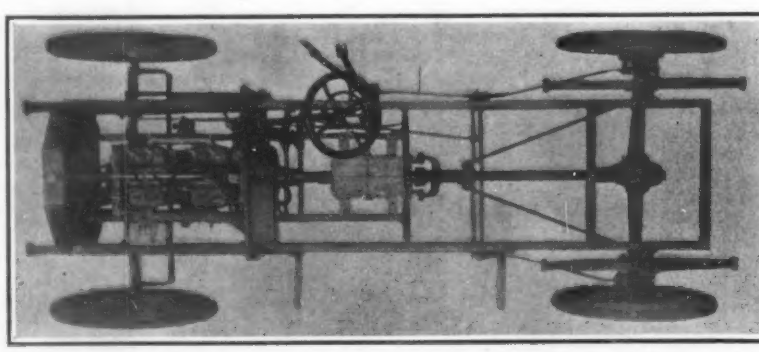


NEW ROLLER-BEARING TRANSMISSION OF CADILLAC LIGHT TOURING CAR.

THE DRAGON CHASSIS.

The accompanying illustration shows a plan view of the chassis of the Dragon light touring car. This is a new machine that has recently been placed on the market, and while the manufacturers do not claim anything radically new in its construction, they do believe that the car has incorporated in it many of the well-tried and proven features used on present-day automobiles. When the car is loaded to its full capacity, it is said to develop at the rear wheels a horse-power for every 100 pounds of weight. The engine is of 26 horse-power. It has inlet and exhaust valves on opposite sides of the cylinders, all mechanically-operated. A mechanical lubricator is placed beside the engine and driven by a belt. The reason for the use of valves on opposite sides of the cylinders is given as greater working efficiency, because the cooling water can be admitted around the exhaust valve (which is the hottest point) and taken out from around the inlet valve, which it keeps at a uniform temperature and thus aids carburetion. The engine is fitted with a reverse cone clutch in the flywheel. The clutch ring can be removed very easily, thus allowing the leather face of the cone to be inspected and cleaned. If necessary, the leather can be readily renewed also. The particular feature of interest about this car is the arrangement of the torque tube and radius rods. There is but one universal joint in the propeller shaft, and this is immediately back of the transmission. The torque tube ends in a pair of U-shaped arms, which are pivoted upon a sliding yoke. The radius rods run from the rear axle to the torque tube near its upper end, where they are attached to a yoke that is slidably mounted upon the torque tube. Thus, the rear axle, torque tube, and radius rods are virtually one solid unit, which can assume any ordinary angle with respect to the frame of the car.

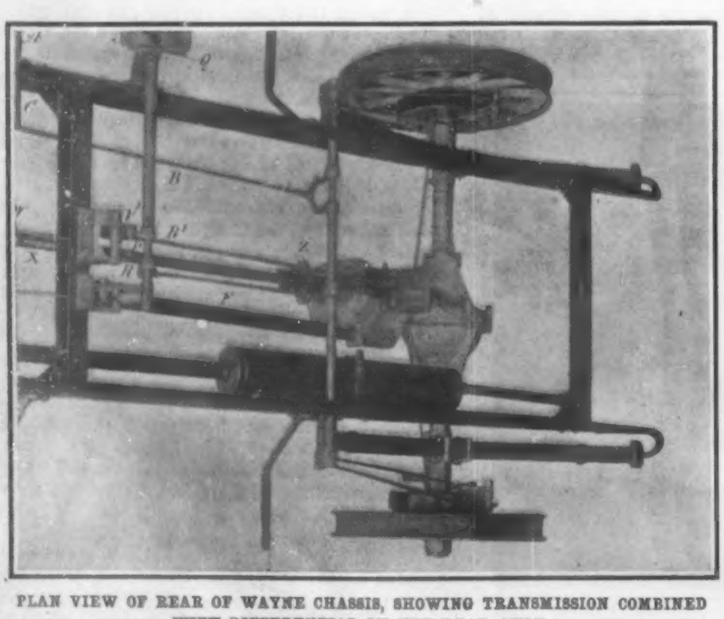
The transmission is of the usual three-speed progressive type. Both it and the engine are mounted on a sub-frame extending from the front to the middle of the chassis.



CHASSIS OF THE DRAGON 26-HORSE-POWER TOURING CAR, SHOWING DRIVING SHAFT INCASED IN TORSION TUBE AND RADIUS RODS BRACING THE LATTER.

THE WAYNE TRANSMISSION AND CLUTCH.

On the Wayne 1907 touring car is seen another design of combined transmission and differential located on the rear axle. In designing its new car this way the Wayne company has but followed out the lines



PLAN VIEW OF REAR OF WAYNE CHASSIS, SHOWING TRANSMISSION COMBINED WITH DIFFERENTIAL ON THE REAR AXLE.

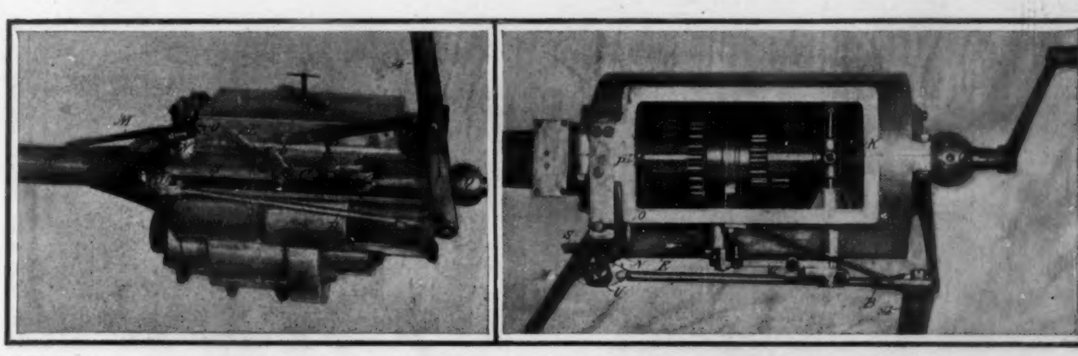
F. Torsion rod. *Q.* H-shaped quadrant for selective-type transmission. *R, R'.* Connecting rods for operating shifting gear sets in transmission. The photograph shows one end of pin, *P*, in engagement with fork, *V'*, the downwardly-projecting lever of which is connected with *R'*. Lever, *G*, is on sleeve, *S*, which carries lever with pin, *P*. *X.* Propeller or universally-jointed driving shaft. *Z.* Rear universal joint of *X*.

REAR OF DASH, SHOWING SPARK COIL, TIMER, CLUTCH, AND CONTROL MECHANISM OF WAYNE 30-HORSE-POWER CAR.

A, B. Brake pedal and connecting rod. *C.* Clutch pedal. *D, E.* Emergency brake lever and connecting rod. *F.* Expanding leather-lined clutch. *G.* Gear-shift lever. *I, I.* Clutch-shifting levers. *J, K.* Clutch collar and shipper. *M, N.* Lever arms that throw out clutch when emergency brake is applied. *P.* Pin on lever of sleeve, *S*, which engages forks *V, V'*. *R, R'.* Connections to shifting-gear sets from *V, V'*.

upon which the Packard and Northern cars have won success during the last two years. In our 1905 Automobile Number we showed the first application of the transmission to the rear axle as displayed on a Packard chassis. Last year the Northern company brought out a 4-cylinder car having this feature, and this year the Wayne and some others are exponents of it. The arrangement is a neat one, and gives, as a rule, little or no trouble.

The two photographs which we reproduce show the arrangement of the gear box on the rear axle and the method of operating the gears. The transmission is of the 3-speed-and-reverse selective type, in which there are two sliding sets of gears, either one of which is picked up when the lever, *G*, is slipped through the "gate," or transverse slot of the H-shaped quadrant, *Q*. When this is done, pin, *P*, on a short lever arm forming part of sleeve, *S* (which *G* turns), slips into one of the two forks, *V V'*, and, when *G* is moved forward or backward in one of the longitudinal slots of *Q*, causes this forked lever arm and its vertical part, *V* (both of which are in one piece forming a bell crank) to move forward or backward one of the sliding-gear members by means of the connecting rods, *R R'*. The other rods, *B* and *E*, apply the contracting running brakes and the expanding emergency brakes to the brake drums on the rear wheels. The brake bands are lined with camel's hair felt, and are operated by pedal, *A*, and lever, *D*, respectively. Pedal *C* throws out the clutch, *E*, when pushed forward, moving backward the lower ends of the levers, *I I*, which are attached to the ring, *J*, of the shifting collar, *K*. The clutch is of the expanding ring type, leather lined. It is placed within a drum in the flywheel, and is so powerful that only a 10-pound spring is required to operate it. Application of the emergency brake throws out the clutch by means of the lever, *M*, traveling along under the curved lever, *N*, and moving it. The propeller shaft is shown at *X*, and its two universal joints at *W* and *Z*. The torsion rod for taking the twisting strains of starting from the springs, is shown at *F*. The springs are placed outside of the frame, which gives them greater play. The rear axle is fitted with Hyatt roller bearings, and the front wheels have adjustable ball bearings. The motor used is a 30-35 horse-power, 4-cylinder, water-cooled engine of 4⅝-inch bore by 5¼-inch stroke. The valves and piping are all on one side, which gives the other side of the motor an especially neat clean-cut appearance. The cylinders are cast integral in pairs. A gear-driven water pump and belt-driven fan and lubricator are fitted. The timer is seen in the dash at *T*.



NOVEL INTERCONNECTED COMBINED CLUTCH AND TRANSMISSION USED ON THE SMITH CAR.

A. Clutch and gear-shift lever. *B*. Connection to slide, *S*. *C*. Clutch-operating lever. *E*. Lever for connecting *C* with brake. *K*. Multiple-disk clutch. *M*, *N*, *O*. Brake lever and plunger. *P*. Band brake. *Q*. Universal joint. *U*. Ball and socket joint. *R*. Propeller shaft.

A NOVEL COMBINED SLIDING-GEAR TRANSMISSION AND MULTIPLE-DISK CLUTCH.

One of the greatest improvements noted on any of the 1907 cars is that seen on the Smith machine, in which the usual three-speed sliding-gear transmission, arranged with a multiple-disk clutch in its forward end, is operated by a single lever, which not only slides the gears, but also throws out the clutch and lets it in again at the proper moment. A general idea of this improvement may be had from the side and plan view photographs which we reproduce. The gear-shift lever, *A*, which is suitably located beside the gear box, is connected through rod, *B*, and universal joint, *U*, with the sliding rod, *S*, which is connected to the shifting fork, *S'* (top view) inside of the gear box. The rod, *S*, has notches on its upper face. The lever, *C*, which rocks the shaft, *P*, and throws out the clutch, has a downward projection on which is mounted a small roller, *a*. When this roller is in one of the notches, as shown in the photograph, the clutch is engaged, but as soon as it is raised and slides along on top of the rod, *S*, the clutch is thrown and held out. When the lever, *A*, is moved so as to slide the rod, *S*, in one direction or the other, projection, *a*, rises and slips along over the top of rod, *S*, thus holding out the clutch until the next set of gears are in mesh. As these gears come into mesh the roller, *a*, falls into the succeeding notch, and the clutch is engaged again. With this arrangement the merest tyro can operate the gear-change mechanism without any danger of stripping or damaging the gears; in fact, the control of this car is as simple as that of an electric car, for all the operator has to do is to push the lever, *A*, forward or backward to pass through the various sets of gears. This transmission is a decided improvement over the usual form, in which the gear box is separate from the clutch and from the engine. It marks a distinct advance in automobile construction, and is a device which will doubtless be imitated by other automobile manufacturers.

THE STODDARD-DAYTON CHASSIS.

The Stoddard-Dayton is one of the best built and most improved types of four-cylinder machines at present on the market. The photograph of the chassis, which we reproduce, shows very well the compact and neat appearance of the mechanism, as well as several of the special features, such as the aluminium protecting casing beneath the machinery. The engine is of the twin-cylinder type, the cylinders being cast in pairs, with the exhaust valves, *E*, on one side and the inlet valves, *I*, on the other side. The cylinders of the touring car engine have a 4⅝-inch bore by a 5-inch stroke. The commutator, *C*, is placed on a vertical post between the two pairs of cylinders, which makes it readily accessible. All the wires, both primary and secondary, are carried through insulating piping to the spark coil on the dashboard. This is of the individual type, there being four separate coils with vibrators. A mechanical force-feed oiler, worked by an eccentric, forces oil at 90 pounds pressure to the three crankshaft bearings and the commutator. Eccentric oil rings beside the bearings catch the oil as it oozes out therefrom and spray it up into the cylinders. Thus it is unnecessary for the cranks to dip in the oil that is kept in the bottom of the crankcase at a certain level by an overflow. The commutator has a special ring for the return or ground wire, an arrangement that makes sure the completion of the primary circuit and does away with an obscure cause of misfiring.

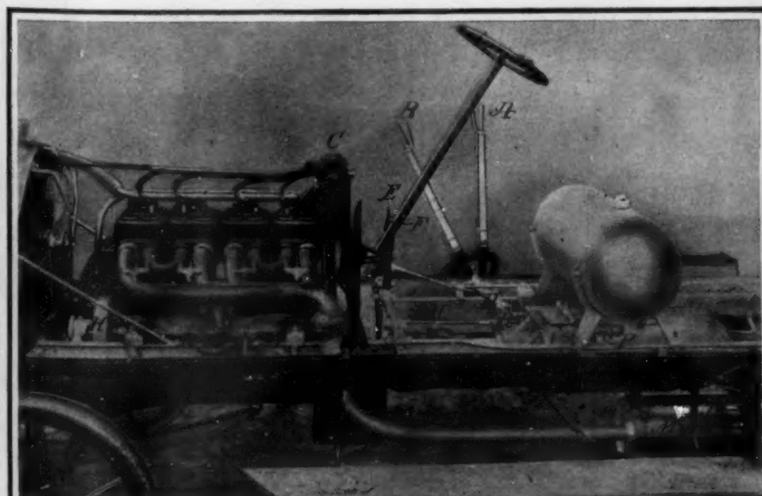
The transmission, as can be readily seen, is very compact. The lay shaft is placed at the bottom, and the ends of the bearings of this shaft are protected by oil-tight caps, so that there is no leakage of oil from the transmission. Although the gear box is quite small, the gears are exceptionally large, being 6-pitch and 1⅛-inch face. Timkin roller bearings are used in the transmission, wheels, and rear axle. The long levers which carry the clutch and brake pedals give so much leverage that a 400-pound compression spring can be used on the cone clutch, and yet the latter can be operated so gently that it is possible to start the car upon the high gear. Both the foot and hand brakes are interconnected with the clutch so that the latter is thrown out when the brakes are applied. Throwing out the clutch also throttles the motor, as the throttle of the automatic, water-jacketed carbureter is connected with the clutch pedal.

The torsion tube hanger, *H*, seen in the photograph, slides in a bronze ring which is attached to a bracket on a cross member of the frame, while the radius rods, *R*, are provided at their forward ends with a ball and socket. The foot brake is of the expanding type, working in a drum at the rear of the transmission. The levers, *A* and *B*, are for shifting the gears and for applying the emergency brakes on the rear wheels. These brakes are also of the expanding type. The transmission is of the three-speed selective type, and any gear can be picked up without going through the other gears, as is necessary with the progressive type of transmission.

THE GROUT 35-HORSE-POWER CHASSIS.

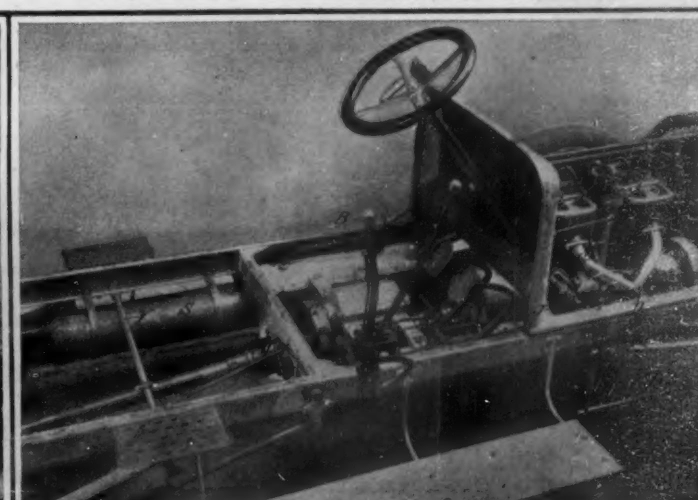
One of the most finished chassis exhibited at the show was that of the Grout car. Grout Brothers still retain the armored wood frame on account of its elasticity. The motor is a 4-cylinder Rutenber of 4½-inch bore by 5-inch stroke, rated at from 30 to 35 horse-power. As can be seen from the photo of the chassis, the valves of the engine are in chambers on one side, and the exhaust and inlet pipes are clamped in place by four brackets secured by four nuts. A Holley float-feed automatic carbureter is located at *K*, and the centrifugal water pump is shown at *H*. Igni-

(*Continued on page 53.*)



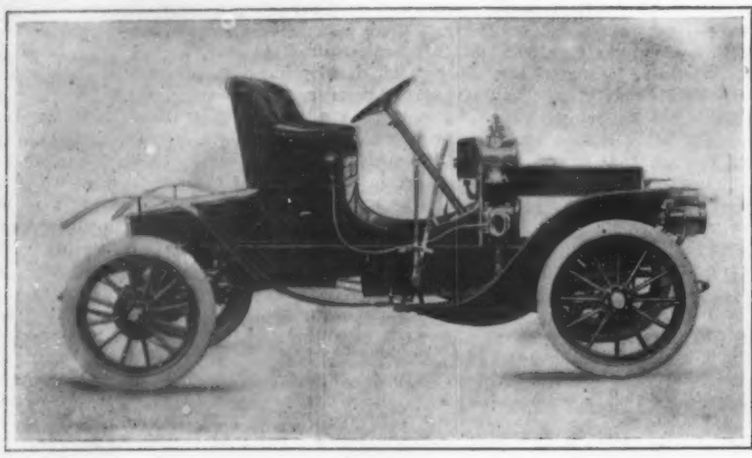
CHASSIS OF THE 35-HORSE-POWER GROUT TOURING CAR.

A. Gear-shift lever. *B*. Brake lever. *C*. Combined timer and distributer. *D*. Lever connecting *A* with *B*. *E*. Brake pedal. *F*. Clutch pedal. *H*. Pump. *J*. Sprocket. *K*. Carbureter. *M*. Muffler. *P*. Gasoline pipe. *V*. Universal joint.



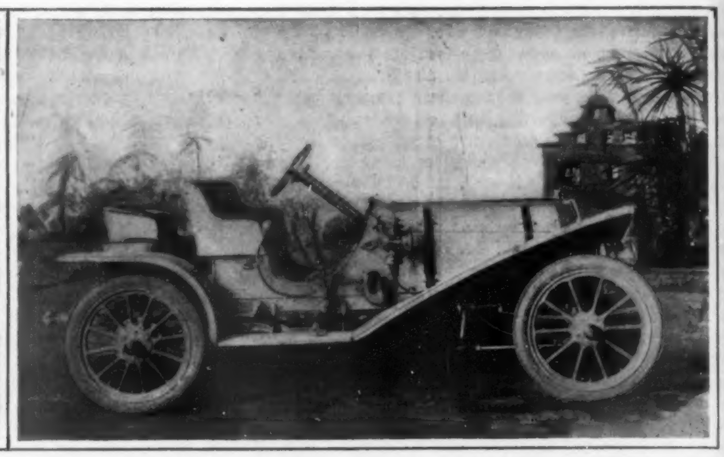
THE 35-HORSE-POWER STODDARD-DAYTON CHASSIS.

A. Gear shift lever. *B*. Brake lever. *C*. Commutator. *D*. Carbureter. *E*. Exhaust valve chambers. *I*. Inlet valve chambers. *F*. Clutch. *G*. Expanding brake drum. *H*. Universal torsion tube joint. *J*. Worm steering gear. *K*, *L*. Steering gear lever and connection. *R*. Radius rod. *S*. Muffler. *V*, *T*. Transverse brake rod and lever arm.



The New 12-Horse-Power Franklin Light Runabout.

Engine: 3¼ x 3¼, 4-cylinder, air-cooled. Transmission: 3-speed progressive type. Clutch: Multiple disk in flywheel. Drive: Shaft. Weight: 1,250 pounds. Wheel base: 90 inches. Tires: Front, 30 x 3; rear, 30 x 3½.



The Oldsmobile 35-Horse-Power Runabout With Rumble Seat.

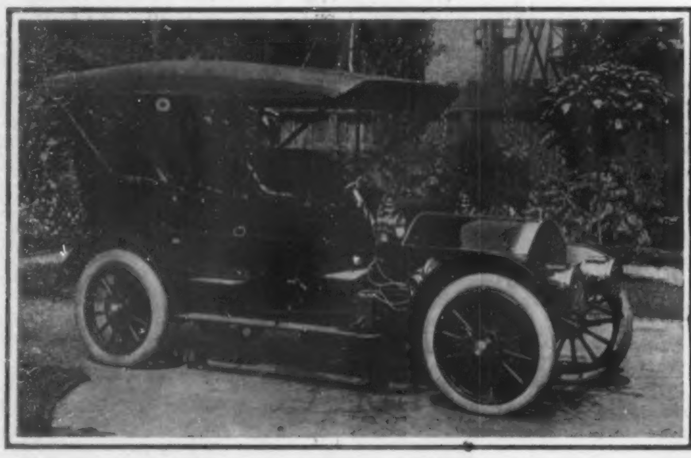
Engine: 4½ x 4¾, 4-cylinder, water-cooled. Transmission: 3-speed selective type. Clutch: Reverse cone. Drive: Shaft. Weight: 2,600 pounds. Wheel base: 106 inches. Tires: Front, 34 x 3½; rear, 34 x 4.

Mrs. F. D. Cottle—98 Years of Age—in a 40-Horse-Power American Mercedes.

Mrs. Cottle made trip from New York to Boston pleasantly and without fatigue in two days. Engine: 120 x 150 mm. (4.724 x 5.905 in.), 4-cylinder, water-cooled. Transmission: 4-speed selective type. Clutch: Metallic expanding ring. Drive: Double side chain. Weight: 3,440 pounds. Wheel base: 127 inches. Tires: 36 x 4.

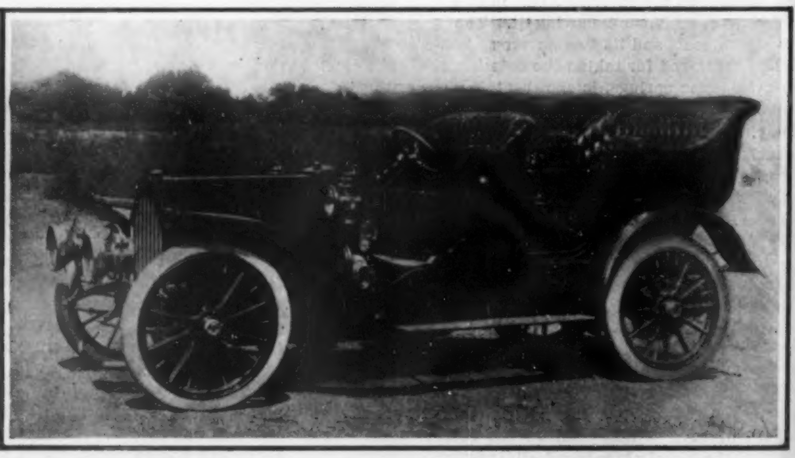
The New 24-32-Horse-Power Model of the American Mors Touring Car.

Engine: 4.9 x 5.9, 4-cylinder, water-cooled. Transmission: 4-speed progressive type. Clutch: Cone. Drive: Double side chain. Weight: 2,500 pounds. Wheel base: 106 inches. Tires: 36 x 4½.



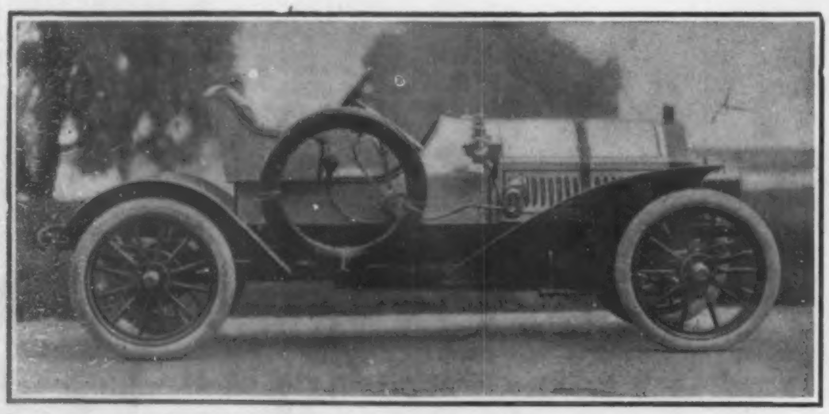
The 45-Horse-Power, 7-Passenger Pierce Touring Car.

Engine: 5 x 5¼, 4-cylinder, water-cooled, with two separate high-tension ignition systems by batteries and high-tension magneto. Transmission: 3-speed progressive type operated by lever on steering column. Clutch: Cone. Drive: Shaft. Weight: 3,700 pounds. Wheel base: 124 inches. Tires: Front, 34 x 4; rear, 34 x 5.



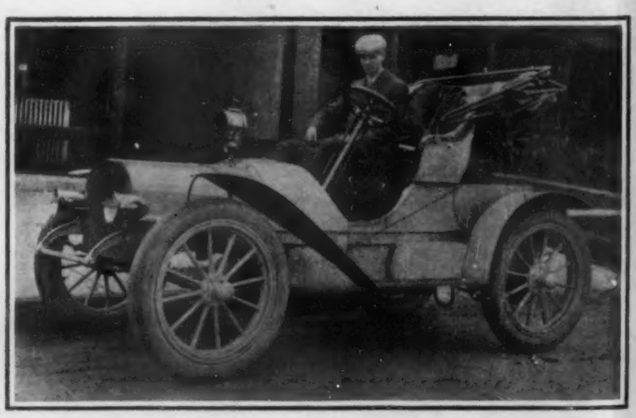
The Pope-Toledo 40-Horse-Power, 7-Passenger Pullman Touring Car.

Engine: 4¾ x 5¼, 4-cylinder, water-cooled, with valves in heads. Transmission: 4-speed selective type, direct drive on third speed. Clutch: Multiple-disk in gear box. Drive: Double side chain from separate countershaft. Weight: 3,200 pounds. Wheel base: 115 inches. Tires: Front, 36 x 3½; rear, 36 x 4½.



The Thomas 40-Horse-Power Two- or Three-Passenger Runabout.

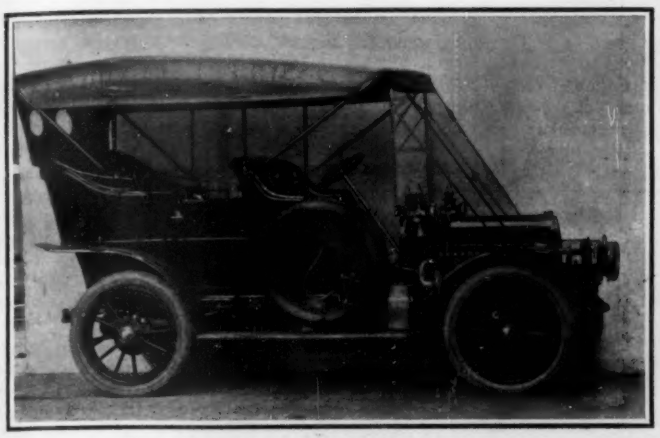
Engine: 4¾ x 5, 4-cylinder, water-cooled. Transmission: 3-speed selective type fitted with roller bearings. Clutch: Cone; interlocked with brake. Drive: Shaft. Weight: 2,500 pounds. Wheel base: 112 inches. Tires: Front, 34 x 3½; rear, 34 x 4.



Electric Touring Runabout Capable of Making 75 Miles on a Charge.

Battery: 24 150 A. H. cells weighing 975 pounds. Motor: 2 H. P. Drive: Double chain. Speeds 10, 12, 14, 24, and 30. Weight: 2,450 lb. Tires: 34 x 4½. For further particulars see current Supplement.

SOME LEADING TYPES OF 1907 AUTOMOBILES.



The 30-Horse-Power Studebaker Touring Car.

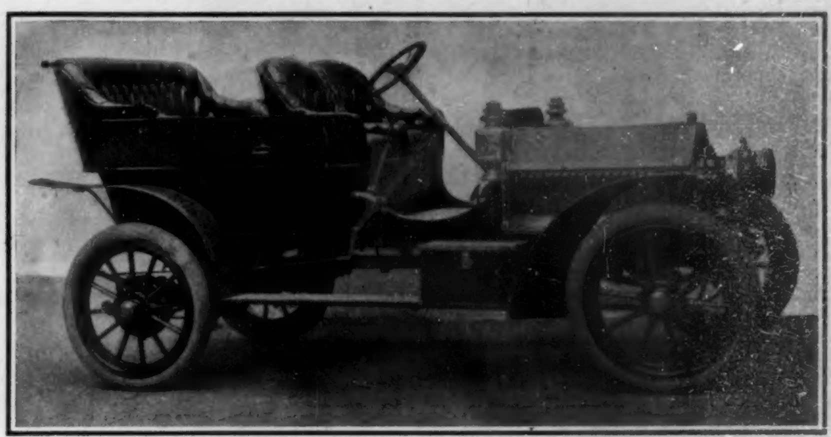
Engine: 4⅛ x 5¼, 4-cylinder, water-cooled; make-and-break igniters with magneto. Transmission: 3-speed progressive type. Clutch: Cone. Drive: Shaft. Weight: 2,400 pounds. Wheel base: 104 inches. Tires: 34 x 4.

The 45-Horse-Power Royal Tourist Limousine for Winter Use.

Engine: 5⅛ x 5¼, 4-cylinder, water-cooled. Transmission: 3-speed selective type. Clutch: Cone. Drive: Shaft. Weight: 3,700 pounds. Wheel base: 114 inches. Tires: 34 x 4½.

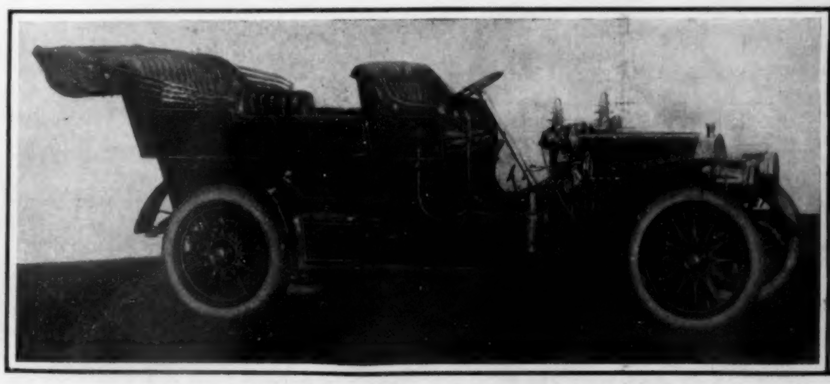
The Frayer-Miller 24-Horse-Power Coupé With Driver's Seat Behind.

Engine: 4 1/16 x 5¼, 4-cylinder, air-cooled with blower. Transmission: 4-speed selective type. Clutch: Cone. Drive: Shaft. Weight: 2,950 pounds. Wheel base: 96 inches. Tires: Solid, 32 x 3½.



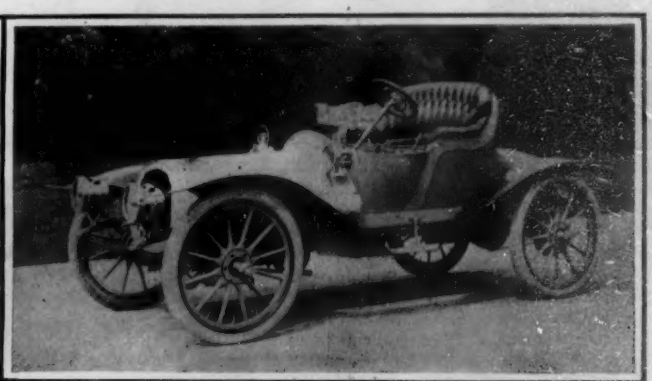
The New 20-Horse-Power Cadillac Light Touring Car.

Engine: 4 x 4½, 4-cylinder, water-cooled. Transmission: 3-speed selective type. Clutch: Cone. Drive: Shaft. Weight: 2,000 pounds. Wheel base: 100 inches. Tires: 32 x 3½.



The Locomobile 35-Horse-Power, 7-Passenger Touring Car.

Engine: 4⅜ x 5⅛, 4-cylinder, water-cooled; low-tension magneto ignition. Transmission: 4-speed selective type. Clutch: Cone. Drive: Double side chain. Weight: 2,800 pounds. Wheel base: 120 inches. Tires: Front, 34 x 4; rear, 34 x 4½.



The 20-Horse-Power Aerocar Runabout.

Engine: 4 x 4, 4-cylinder, air-cooled. Transmission: 3-speed progressive type. Clutch: Multiple-disk. Drive: Shaft. Weight: 2,100 pounds. Wheel base: 104 inches. Tires: 36 x 3½.

The 16-Horse-Power Maxwell Touring Car Which Ran 3,000 Miles Without Stopping the Engine.

Engine: 2-cylinder, 5 x 5, double-opposed type, water-cooled. Transmission: 3-speed progressive type. Clutch: Multiple disk in gear box. Drive: Shaft. Weight: 1,700 pounds. Wheel base: 86 inches. Tires: 30 x 3½.

The New White 30-Horse-Power Steam Touring Car With Pullman Body.

Engine: Compound with cylinders of 3 and 6-inch bore by 4½ inches stroke. Boiler: Flash type maintaining steam pressure constant at 600 pounds. Weight: 3,000 pounds. Wheel base: 115 inches. Tires: Front, 36 x 4; rear, 36 x 4½. The new method of closing the space between the fenders and running board and the body by means of patent leather strips secured by lacing or buttons, is shown in the photograph. The new type of square oil lamps are also to be noted.

SOME LEADING TYPES OF 1907 AUTOMOBILES.

CONTROLS

THE OLDSMOBILE CHASSIS.

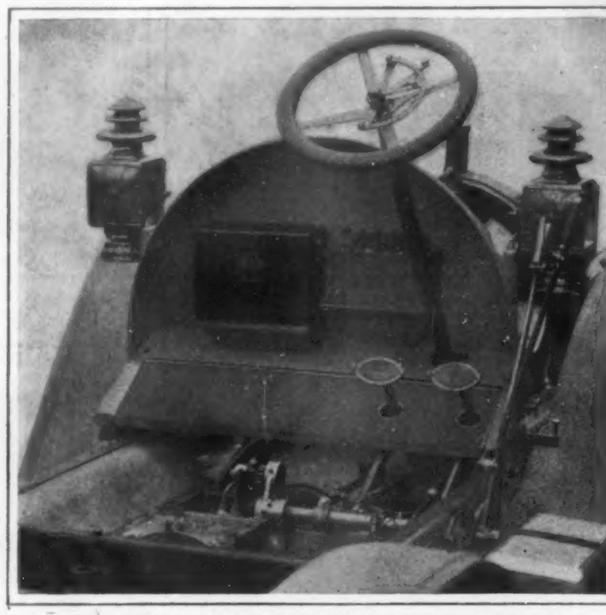
By constructing their chassis so that either a touring car, a limousine, or a runabout body can be fitted, the Olds Motor Works have confined themselves to the production of a single standard model chassis for their three types of 1907 cars. This chassis is fitted with a 4½ x 4¾-inch, 4-cylinder, vertical motor rated at 35-40 horse-power. The motor is much the same as that used last year, its principal feature being the method of lubrication, which is effected by an oil pump that forces oil through passages in the crank case, and continually deluges the main bearings with a liberal supply of lubricant. These bearings are of Parsons white metal, and they are of exceptional length. A novelty about the clutch is the use of an extra spring between the cone and the flywheel, which makes it possible to let in the clutch more easily, as it forms a spring take-up for the load. The transmission is of the three-speed selective type, and the final drive is by propeller shaft and live floating rear axle. Roller bearings are used in the axle and front wheels. Expanding brakes are fitted in the rear-wheel hub drums, while the regular running brake is mounted just back of the transmission and is of the usual contracting type, lined with camel's hair felt. One of our illustrations (on page 32) shows the runabout with rumble seat, while the other picture, showing the control, displays the rather unusual use of doors at the front seat on the touring car. As can be seen in the latter picture, the spark and throttle control levers are on the steering column below the wheel—a rather unusual place for them on a 1907 model. The spark coil and mechanical oiler are placed upon the dash. The floor boards have several trap doors, thus making the clutch and the transmission easily accessible. The emergency brake is applied by pulling back on the lever instead of pushing it forward. This is a practice which is in vogue this year on many of the new cars. The Oldsmobile was one of the gold medal winners in last year's Glidden tour, one of these cars, driven by the late Ernest Keeler, having made a perfect score, though driven at a rapid rate over extremely rough roads. One of the 1907 touring cars is at present engaged in a long-distance touring race from New York to Ormonde Beach, which it is expected to reach in time for the races on January 22. The progress has been very slow, however, on account of extremely muddy roads filled with deep sink holes, encountered in Virginia.

DASHBOARD OF OLDSMOBILE, SHOWING CONTROL LEVERS AND PEDALS.

Note the push pedals on long levers passing through slots in floor, the throttle and spark levers on steering column below wheel, and the gear-shift and brake levers at side. Small doors at the front seat entrances are also a feature of this car.

THE ROYAL TOURING CAR AND LIMOUSINE.

The handsome limousine shown on page 33 is the latest product of the Royal Motor Car Company, of Cleveland, Ohio. This company, like many other large automobile concerns, is this year building but a single standard chassis, to which any one of a considerable number of different bodies, such as the limousine just mentioned, can be fitted. This chassis is built up on a pressed-steel frame which carries a 5¼ x 5½-inch, 4-cylinder, water-cooled engine of 45 horse-power. The picture of the dashboard and control levers, shown herewith, gives a good idea of the neatness and the simplicity of the mechanism. The cone clutch is seen in the flywheel, as well as the two rubber-padded push pedals that operate the clutch and the brake. The top of the gear box is visible in the foreground, and above and in front of this are to be seen a couple of toothed sectors. One of these sectors is mounted upon the sleeve that carries the gear-shift lever on the outside of the frame, and when the lever is moved back and forth, the sector revolves a pinion with which it meshes. On the same shaft with the pinion is a second sector meshing with a rack on the sliding gear-shift bar. Through this second sector and rack, therefore, the movement of the gear-shift lever is transmitted to the rod that slides the gears. This arrangement is shown in detail on page 56. It is a positive method of shifting the gears. The brakes used on this car are of very liberal dimensions, and the brake shoes can be readily renewed. The car is provided with sheet-metal pans, which completely inclose the under side of the engine and transmission. These pans can be readily removed for cleaning, but they are so arranged that adjustments can be made without the necessity of taking them off. Another feature is a ratchet wheel at the rear of the transmission, for the purpose of checking the car from running downhill backward should the brakes fail.

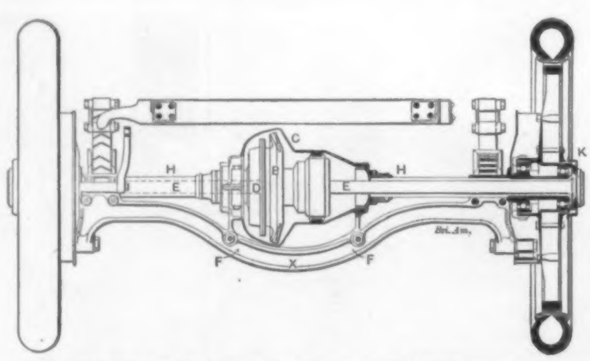


CURVED METAL DASH OF ROYAL TOURIST CAR, SHOWING CONTROL MECHANISM.

The spark coils and oiler are supported on brackets formed in the dash. The pedals are fitted with removable rubber pads and have a downward movement through round holes in the floor boards. The gear-shift lever operates two toothed sectors and pinions (seen at the center) for shifting the gears.

AN IMPROVED TYPE OF LIVE REAR AXLE.

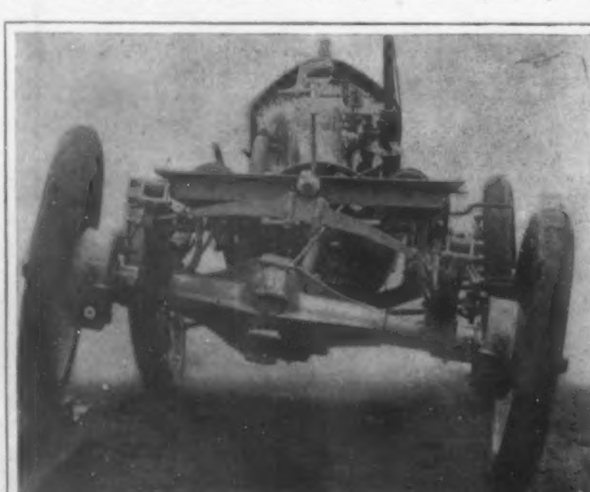
The rear axle of the new Car de Luxe is similar to that used on the De Dion runabouts for a number of years past. A solid I-beam rear axle, with a downward curve in the center, is used to support the usual form of revolving rear axle contained in an outer tubular sleeve. The rear axle proper has the usual spur gear differential, *D*, with a large driving bevel gear, *B*, attached to its casing. All this mechanism is inclosed in an outer steel casing, *C*, which is supported upon the I-beam rear axle at points, *F F*. The usual square end drive shafts, *E E*, extend from each side of the differential through holes in the solid axle, *X*, and through the wheels, which they drive through suitable clutches, *K*, on the outside of the hubs. These drive shafts are protected by an outer tubular casing, *H*, which is fastened to the stationary axle, *X*, at the springs and is also clamped to the differential casing, *C*, at the center, thus serving to tie together this casing and the stationary axle. The result is that the inner floating axle, *E*, is thoroughly protected, and its inclosing tubes are rigidly tied to the differential casing and the solid rear axle. The wheels run on ball bearings on hollow spindles, which form part of the end of the solid rear axle.



SOLID I-BEAM REAR AXLE OF CAR DE LUXE, COMBINED WITH FLOATING-TYPE, LIVE, DRIVING AXLE.

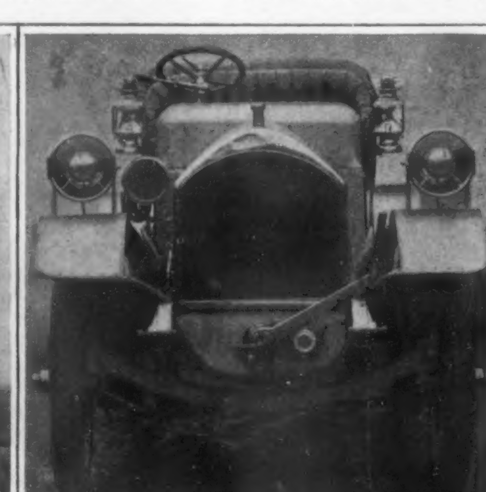
THE NORTHERN FOUR-CYLINDER 50-HORSE-POWER CAR.

After carefully testing the air-control features during last sea- *(Continued on page 53.)*



REAR END OF NORTHERN CHASSIS, SHOWING PIVOTED TRANSVERSE SPRING.

The rear axle is of the live floating type, the outer casing being strongly reinforced by ribs, as shown. The propeller shaft is seen running forward to the air clutch in the flywheel. The wide band brakes are operated by compressed air. Grease cups are fitted to all the pivot pins at the springs. By pivoting the rear transverse spring the twisting effect of the latter upon the body is done away with.



FRONT OF NORTHERN CAR, SHOWING LEVER CONTROL ON STEERING COLUMN.

The front axle is a heavy I-beam manganese bronze casting. The tie rod connecting the steering lever arms is behind the axle. A long lever is used for starting the engine instead of the usual crank. Pulling this lever automatically retards the spark. The lever on the steering column below the wheel shifts the gears, while by twisting the grip the clutch can be applied or released. The spark and throttle levers are above the steering wheel. Note also the location of the acetylene lamps on fenders.

LUBRICATORS

SOME INTERESTING MECHANICAL LUBRICATORS.

The question of lubrication is so vital to the proper operation of an automobile, that every attention is now being paid to the design of the mechanism which will positively circulate the oil to the various bearings. At the same time, simplicity of design is at a premium; and among the various examples of lubricators which are herewith illustrated, a great deal of ingenuity has been exhibited, with the purpose of cutting down the number of parts to a minimum, and eliminating all such elements as are liable to get out of order. In Fig. 1 we show a lubricator in which the pumps are arranged in pairs, one of each pair being adapted to force oil to the sight feed, and the other from the sight feed to the point of lubrication. The two pumps are indicated at *C* and *D*. Each is attached to a yoke lever, *E*, which engages the eccentric, *J*. The latter is rotated by means of a worm, *L*, and gear, *K*. A pin carried by the arm, *F*, is adapted to engage a groove in the lever *E*, and serve as a pivot therefor. The arm, *F*, is threaded onto the rod *G*, which extends through the upper end of the reservoir *A*, and terminates in the thumb nut *I*. By turning this nut the pivot pin may be raised or lowered to regulate the stroke of the pump *C*. The latter pump delivers to a standpipe *S* in the sight-feed glass, whence the oil drops into the tube *B*, and is forced by the pump *D* to the point of lubrication.

In Fig. 2 we show a pump which is not fitted with a sight feed because the plungers operate in plain sight. This is a very compact oiler, in which the pump pistons are driven directly by a camshaft without any intermediate gearing. The piston rods are formed with rectangular offsets, against which the cams operate. The pistons are arranged in two banks of three each, and there are two oppositely-disposed cams on the camshaft, which serve alternately to lift the banks of pistons. On the downward stroke the pistons are lowered by means of coil springs. The upper ends of the pistons project through the cover of the oil reservoir or tank, and each carries a thumb nut and jam nut. These nuts serve to limit the extent to which the pistons may be forced down into the cylinders, and they may be adjusted to regulate the length of the stroke of any one of them. The camshaft is intermittently driven by means of a ratchet wheel and pawl. By regulating the throw of the pawl, the speed of the camshaft may be varied, as desired. The ratchet mechanism is operated by a crank projecting through the cover of the oil tank. There is thus no chance for leakage, as none of the moving parts passes through the tank below the surface of the oil.

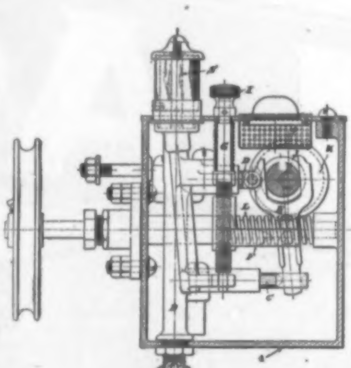


Fig. 1.—A SINGLE YOKE DRIVES BOTH SIGHT-FEED AND DELIVERY PUMPS.

Many lubricators have been ingeniously devised to avoid the use of springs and loose valves. Some of these mechanisms are provided with rotary valves, positively driven. An interesting example is shown in Fig. 3. As in the first example, this lubricator is formed with pairs of pumps serving respectively to force oil to the sight feed and to the delivery points. The worm *A* drives the gear *B*, and on the gear shaft are the eccentrics which operate the straps *X*. Hinged to each strap is a lever *E*, which at one end carries the piston *F*, and at the opposite end is allowed a certain amount of play between the pin *N* and the slide *O*. The amount of play may be regulated by operating the nut *P*. The piston *F* operates in a cylinder *G*, at the upper end of which is the valve *H*. The latter is rotated by means of a crank *J*, shown by dotted lines, which is connected with a crank offset on the main shaft. On the downward stroke the suction port *L* is uncovered, permitting the cylinder to fill with oil. On the upward stroke this port is closed and the port *M* uncovered, permitting the piston to force oil to the sight feed. From this point the oil is pumped to the delivery points by an adjacent pump identical with the one just described, except that the lever *E* is pivoted to the pin *N*, and cannot be adjusted to vary the stroke of the piston.

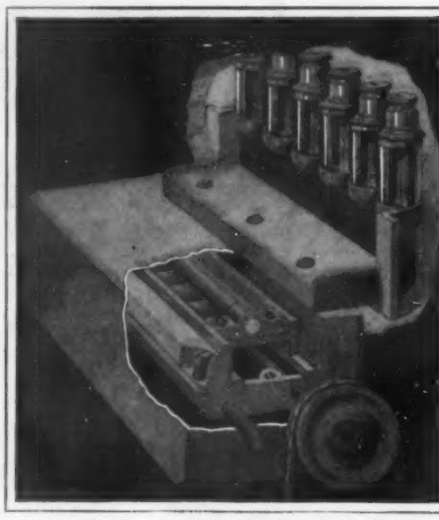


Fig. 5.—SLIDING CYLINDER PUMP.

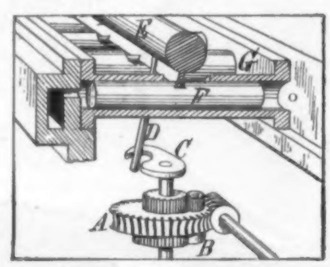


Fig. 6.—DETAILS OF SLIDING CYLINDER PUMP.

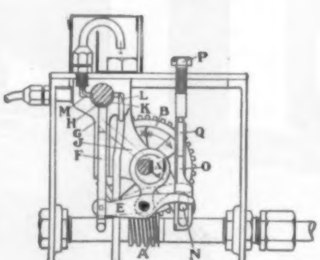


Fig. 3.—DOUBLE PUMP LUBRICATOR WITH ROTARY VALVE.

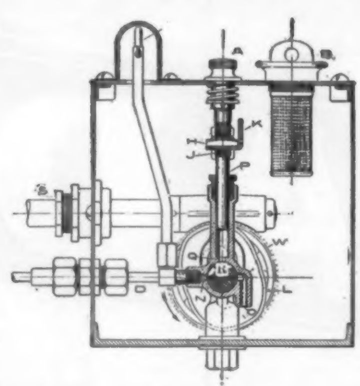


Fig. 4.—PUMP DELIVERS ALTERNATELY TO SIGHT-FEED AND BEARINGS.

Fig. 4 illustrates a lubricator of somewhat similar type, except that in this model a single pump serves first to force oil to the sight feed and then to deliver this oil under pressure to the various bearings. The power shaft *S* drives the valve shaft *V* through the medium of the worm gear *W*. The valve chamber communicates with each pump cylinder through a port *Q*. The valve shaft is formed with ports *R* at opposite sides, there being a pair of opposite ports for each cylinder. These ports are not cut in the same plane, but are adapted to communicate alternately with the delivery ports *N* and *D*, which lead respectively to the sight-feed tube and to the parts which are to be oiled. The pump pistons *P* are operated by a crosshead *K*, which is reciprocated by the cam *L*. On the upward stroke the crosshead bears against the nuts *H* and, on the downward stroke, against the pins *J*. By means of the thumb nuts *A*, the pistons may be screwed down through the nuts *H*, providing a certain amount of play between the latter and the pins, and thus shortening the stroke of the pistons, or even stopping the motion of any one of the pistons, if desired. Each piston makes two complete operations during every revolution of the valve shaft. In operation, on the upward stroke of the piston, the port *R* of the valve shaft will open communication between the cylinder port *Q* and the suction port *O*, and on the downward stroke it will open communication between the port *Q* and the delivery port *N*. On the next upward stroke the alternate port *R* will connect port *Q* with port *O*, while on the next downward stroke it will connect port *Q* with port *D*.

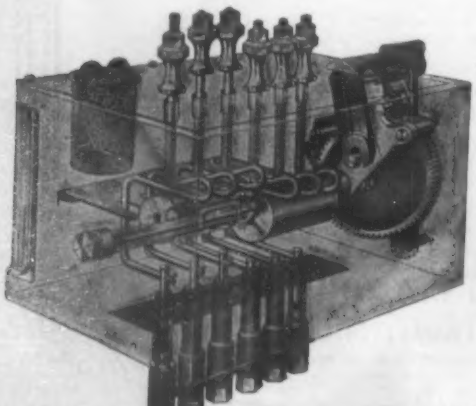


Fig. 2.—THE PISTONS ARE DIRECTLY ACTUATED BY CAMS.

Figs. 5 and 6 illustrate a pump of peculiar type, in which valves are dispensed with, but the cylinders instead are bodily moved from suction port to delivery port. The pistons operate at one end to pump oil to the sight-feed tubes, while at the other end they force oil to the bearings. The pumps are driven by means of a worm gear, *A*, which acts through a ratchet *B* to rotate a vertical shaft carrying a crank *C*. This crank engages a pin *D* on the rockshaft *E*, and as the crank revolves, it not only rocks the shaft, but gives it an axial reciprocating motion. This axial movement of the shaft alternates with its rocking motion. The pump cylinders are formed in a slide *G*, through which the pin *B* projects, and by which the slide is carried back and forth, bringing the cylinders alternately into register with the suction and discharge ports. At the same time the pistons *F* are reciprocated by a feather on the rockshaft *E*. Four distinct operations are produced by each complete rotation of the crankshaft. In the first quarter the rockshaft is rotated, causing the pumps to fill at one end from the receiving ports, and at the other to discharge oil to the bearings. In the second quarter the slide *G* moves lengthwise, bringing the cylinders into register at one end with the delivery ports leading to the sight feed, and at the other with the ports leading from the same, so that in the third quarter, when the pistons are again operated, at one end they force oil into the sight-feed tubes, while at the other end they suck in oil from the same. The cycle is completed in the next quarter, when the parts are returned to the first position ready to force the oil from the cylinders to the various delivery points.

An ingenious pump of the valveless variety, in which the piston itself serves as a valve, is shown in Fig. 7. The sight feed in this construction is rendered unnecessary by reason of the fact that the pump pistons project through the cover of the oil tank, and as there are no valves or springs, the motion of these plungers is sufficient to guarantee that the oil is being properly delivered to the bearings. The mechanism is driven by a worm gear, which drives the camshaft. The cams are eccentric in form, serving to produce a reciprocating motion of the pistons, which are connected to them by means of straps. The straps, however, do not directly engage the cam, but they carry adjustable studs, which bear against the working faces of the cams. In addition to the reciprocating motion, the pistons are given a rotary motion by a pin projecting from each cam, which bears against the curved face of the strap. At its upper end each strap is held vertical by means of a shank projecting through an open-

(*Continued on page 56.*)

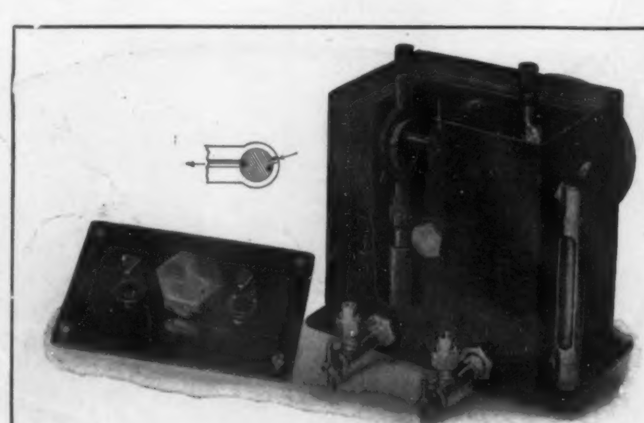


Fig. 7.—THE PISTONS ROTATE TO SERVE AS VALVES.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

BUILT-UP INSULATOR.—L. STEINBERGER, New York, N. Y. The invention relates to insulators of the kind used for currents of high potential and in which it is desirable to secure the greatest possible dielectric quality combined with a maximum of physical strength and a mimimum of materials and weight. The invention enables the operator to readily take the same partially apart without interrupting the service, so as to examine the interior portions of the insulator for the purpose of cleaning it or for coating the exposed surfaces or to replace the oil used for increasing the insulation.

INSULATOR FOR HIGH VOLTAGES.—L. STEINBERGER, New York, N. Y. This improvement refers to insulators for electric conductors, and especially to insulators for conductors conveying currents of high potential. The main object is to prevent any leakage of current or the possibility of the formation of a destructive arc between the conductor and the line-support, such as a partition or wall, and also to prevent the leakage of the current and the formation of arcs between the conductors and adjacent bodies. Mr. Steinberger further seeks to provide the insulator with hoods movable relatively thereto, whereby the arcing distance may be varied and the hoods disposed to best advantage.

Of General Interest.

ATOMIZER.—F. S. DICKINSON, New York, N. Y. An object of this invention is to provide a force-pump to be used in connection with an atomizer, wherein a spring is employed for the return stroke, thereby avoiding muscular action to operate the plunger on the return stroke, which greatly facilitates the operation of the instrument.

CEMENT PAVING.—R. KIESERLING, Altona, Elbe, Germany. The present invention relates to improvements in the production of cement paving for streets, roads, floors, yards, closed rooms, and so on. One part of the subject matter of the invention relates to the production of elastic joints in cement paving, which joints make the same permanently free from cracks. Another part of the subject matter relates to means for producing such elastic joints in the paving.

FRAME FOR MAGNIFYING GLASSES.—W. J. KEMLER, Pittsburg, Pa. The purpose of the invention is to provide a frame, so constructed that it can be compactly and flatly folded when not in use and quickly and conveniently opened out for use as a standing frame or an eyeglass-frame or so that all the members are placed in practically horizontal alinement, in which latter position of the parts one member can be utilized as a handle and the lens member employed for reading purposes, thus enabling the same device to be used as an eyeglass, a standing view or magnifying glass, and a reading-glass.

CANDELABRUM.—A. C. GUNTZER, New York, N. Y. One purpose of the inventor is to provide a candelabrum wherein the body portion is in the form of a cross revolubly mounted upon an adjustable standard and to provide the standard with removable legs at its base and also to provide readily locking devices for the legs. Another purpose is to construct the cross forming the body in sections readily removable, and which when assembled will not show their points of connection at the front, and to provide means for securing sections firmly in place, which means can be quickly and conveniently applied and are not visible at the front of the body.

UNDERREAMER.—J. F. THOMPSON, Marietta, Ohio. Mr. Thompson's principal objects are to provide means whereby the reamer can be lowered through a casing, automatically expanding when it reaches the end of the casing and having no parts extending materially below the working edges of the bits; also, to provide means for manipulating the bits for lowering the reamer in the casing without interfering with operation of same when it reaches the lower end thereof to provide means for holding the bits in expanded position to operate the device for reaming and to avoid vertical motion of the bits with respect to the body of the reamer.

TOBACCO-CONTAINER.—W. H. BROWNING, New York, N. Y. This invention is an improved device primarily for containing cigars and keeping them in proper moist condition, but may be used with advantage for containing tobacco in other forms. The object is to overcome former disadvantages and produce an effective device for holding the cigars which will at all times keep them in proper order.

COMBINATION NOTE-BOOK, COPY-HOLDER, AND TOOL-KIT.—G. H. RICHARDSON, San Francisco, Cal. The object in this case is to provide a note-book stand, copy-holder, and tool-kit for the use of stenographers and arranged to hold a note-book or a loose copy in a most advantageous position, readily to accommodate various tools and to allow of convenient folding into little space for storing or for shipping purposes. The clasp on the front shelf will hold an incoming letter, which the stenographer frequently has occasion to refer to, by the top edge, letting said letter hang down in front of the operator, who then may see at a glance both the letter received and the stenographic notes for the letter to be forwarded.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(10288) H. L. P. asks: 1. Can Ohm's law (current = pressure ÷ resistance) be read also resistance = pressure ÷ current, or pressure = current × resistance? I hear that Ohm's law is not strictly true. To what extent is this true? A. Ohm's law is true. The values of resistance and current as you give them are correct. Anyone who has studied algebra would read these values at sight. 2. What is Ampere's law? A. Ampere's law relates to the attractions and repulsions of currents upon each other, and is at the foundation of the use of electricity in motors. You will find them in such a book as Thompson's "Electricity," price $1.50, or in Sloane's "Handy Book of Electricity," which we send for $3.50. This last is a very valuable book for one who would learn all about the subject. 3. Is there any way of transforming a direct current without combining a motor and dynamo? Thus: How can 1 volt × 12 amperes = 12 watts be changed to read 6 volts × 2 amperes = 12 watts? A. There is no way, except by a motor dynamo, to transform a direct contiguous current into another direct continuous current. 4. When transformers are used on electric lighting circuits, is not the current similar to the secondary of an induction coil? A. A transformer is only a special form of an induction coil. Used with an alternating current, it need not have a vibrator or interrupter. 5. What is the nature of secondary current of induction coils? A. The secondary current in an induction arranged for giving a spark is an interrupted direct current. The plus end of the spark remains at the same pole of the coil. The spark passes all the time in the same direction.

(10289) W. P. K. asks: In the SCIENTIFIC AMERICAN SUPPLEMENT of April 7 last, it is stated that the ultra-violet rays have proved singularly successful in curing baldness; twenty-seven cases out of thirty-two submitted to the treatment having been perfectly cured, though many of the cases were of many years' standing. As this is a matter which interests many of your readers in the present, and is likely to interest most of us in the future, you may perhaps be so kind as to favor us with some information on the subject. First, do you happen to know, or to have heard, of any case of baldness submitted to and cured by this treatment? Secondly, considering the powerful action of the ultra-violet rays on the human body, is there no danger likely to be incurred in submitting a part so important as the head to their influence? A. Several esteemed correspondents ask regarding the production of hair by ultra-violet rays. The simplest way to get ultra-violet rays into contact with the scalp is to go in the sunshine without a covering for the head. If all did this, there would probably be no baldness. The tight hat impedes the circulation of the blood through the scalp, and the hair dies. We have no other information regarding the treatment referred to in the note than is given in the SUPPLEMENT named.

(10290) A. M. D. asks: Through the columns of your valuable paper will you please give a decision on the following dispute? A claims that in the manufacture of a mirror, the chemical reaction generates an electric current, the glass acting as a conductor on which the silver deposits. B claims the glass is a non-conductor, and the action is purely chemical. Will you please state which is correct. If B is correct, does the hardness of the glass surface have anything to do with the brilliancy of the deposit? A. The precipitation of silver upon glass in silvering a mirror is a simple chemical action due to the presence of some reducing agent, such as glucose. There is no electrical action whatever, and glass is not a conductor of electricity, but a strong insulator.

(10291) H. W. S. asks: Does it take more power to pull a 100-light dynamo when 100 lights are used, than it does when there is only one light used? Dynamo in both cases registers 110 volts. A. Does it take more gas to light 100 lights than it does to light one light? This is a parallel question to that above. A dynamo which is lighting one lamp is furnishing the amperes necessary to light one lamp. A dynamo which is lighting 100

(Continued on page 39.)

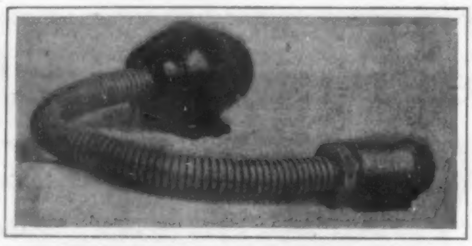
NOVELTIES

AN IMPROVED IGNITION DYNAMO.

The ignition dynamo shown herewith is one of the best constructed and finished dynamos on the market to-day. Great care is taken in selecting and putting together the materials, and every armature is wound by hand. The armature cores are made up of ninety iron disks separated by fiber disks, each one of which is separately keyed to a steel sleeve that fits over the armature shaft and is keyed to the latter. The disks are compressed by hydraulic pressure into a space 2½ inches in length. After the armature has been wound, in addition to the double insulation on the wire, the whole armature is impregnated by a vacuum process with insulating material.

A new feature consists of a steel tube which completely surrounds the armature and supports the poles, holding them in place inside of the outer casing. This new construction has been found of great advantage, in that it retains ample residual magnetism to enable the machine to build up quickly, and also that it maintains the commutation point neutral, thus making it possible to run the machine in either direction with a like result, and also entirely eliminating sparking at the brushes. The commutator is made up of copper and fiber segments forced together under great hydraulic pressure, and held by two double washers and a steel tube hydraulically swaged. The bearings and armature shaft are of liberal dimensions, and each bearing is supplied with an oil cup fitted with a wick. The combination graphite and bronze-gauze brushes give the lubricating qualities of the former substance and the conductivity of the latter. The leads to the brushes are carried through watertight bushings in the casing. The dimensions of the dynamo are 6 x 6 x 10¼ inches. At 800 R. P. M. it will charge a 4-volt battery at a 3-ampere rate, and at 1,000 and 1,200 R. P. M. it will maintain the same charging rate with a 6- or an 8-volt battery.

The conical bevel pulley with an automatic governor is one of the features of the Apple dynamo. The latest arrangement provides for the mounting of this pulley and its governor next to the flywheel of the engine, while connection is made with the dynamo by means of an inclosed flexible shaft running in Hess-Bright ball bearings. The dynamo can thus be placed in an accessible position, as on the running board. In connection with this arrangement the inventor has designed a combination fitting to go on the dash, consisting of a small volt and ammeter, an automatic switch, and a snap switch having several positions. By turning the latter switch the driver can see the voltage of the battery alone, or when charging. He can also have indicated on the ammeter the rate of charge and the rate of discharge. By adjusting the governor pulley so that the charging rate is the same as the rate of discharge, the battery is always kept charged and is merely floating on the dynamo circuit, which is closed by the automatic switch as soon as the dynamo comes up to speed, and opened again when it stops. With this device it is practical to run electric headlights from an 8-volt battery, and in all probability a future development will be the production of a somewhat larger dynamo, with which powerful electric searchlights can be used in place of the undependable acetylene lights of to-day.

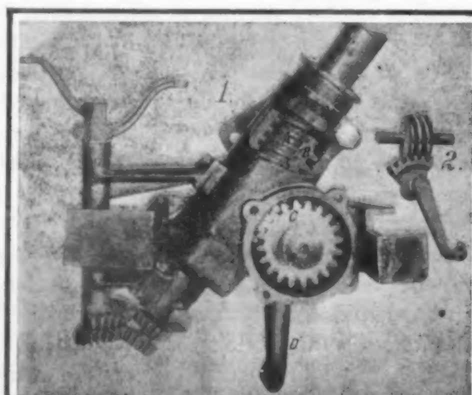


DYNAMO WITH INCLOSED BALL-BEARING FLEXIBLE SHAFT.

IMPROVED APPLE IGNITION DYNAMO.

AN IMPROVED TYPE OF STEERING GEAR.

In place of the usual type of worm and sector steering gear (shown in Fig. 2 in the accompanying cut) the Aero Car Company has adopted an improved type known as the worm and nut system. This consists of a worm thread cut upon the shaft, *A*, of the steering column, and being surrounded by a threaded nut, *B*, that has on its lower surface a rack. This rack meshes with a pinion, *C*, which is mounted on a horizontal transverse shaft that carries the steering lever arm. As the nut *B* is of considerable length, and engages many more threads on the steering column than does the sector shown in Fig. 2, the wear of the threads is inappreciable and never needs adjustment. The same is the case with regard to the rack and pinion. The whole device is incased and runs in oil, while the horizontal shaft carrying the pinion is mounted on roller bearings.



TYPICAL WORM AND NUT STEERING GEAR USED ON THE AEROCAR.

Nos. 1 and 2. New and old-type worm steering gear.

The arrangement for operating the throttle and spark advance levers, by means of bevel pinions on the ends of hollow and solid rods that pass up through the steering columns to the steering wheel, is apparent in the illustration. These bevel pinions mesh with bevel sectors on the bottom of the vertical shafts that carry the lever connections to the throttle and timer.

AN INSTRUMENT FOR TESTING SHOCK ABSORBERS.

For the purpose of determining the relative merits of shock absorbers, the students of the Massachusetts Institute of Technology have made use of a special apparatus, which has been adapted from a device originally designed for determining the variations of load on the driving springs of a locomotive. It is the function of the instrument to determine the motion between the car body and the axle, and the time during which the motion occurs.

The apparatus consists of two rolls, *A* and *B*, carrying metallic-faced paper. The paper is unwound from the roll *A* to the roll *B* over a curved plate by means of an electric motor *C*, which drives the worm and wheel *D*, connected with the roll *B*. The apparatus is intended to be bolted to the floor of a car directly over the rear axle. The vertical slide *E* is connected with the middle point of the rear axle through a reducing motion and two universal joints. A lever *K O*, pivoted at *O*, is embraced by the guide members *N*, and also is connected at its middle point with the slide *E*, through the link *M*. The axle of the car is embraced by the clamp *J*. At each end of the connecting link *L* are universal joints *K K*. This system reduces the motion one-half.

In order to obtain a record upon the metallic-faced paper, three styli are employed. A metallic tracing point, *F*, records the vertical motion of the car body relatively to the axle, and draws merely a horizontal line if there are no vibrations. The metallic point *H* draws a zero or datum line. Since the paper is driven at some speed, and the point *F* moves up and down upon it, it follows that a curve is drawn which indicates movement, while the abscissas indicate time. But inasmuch as the speed of the paper is not constant, such a record would not be sufficiently exact. A tracing point *G*, or rather a perforator, is therefore employed, which is carried at the end of an electro-magnetic arm, and which, in response to the regularly-timed impulses of a circuit controlled by a clock, perforates the paper at every fifteen seconds. A storage battery (Fig. 5) is used to drive both the motor and the clock.

Figs. 1 and 2 are reproductions of records which have been obtained with this device, the one without, the other with Kilgore shock eliminators fitted to a Thomas car. The undulating line which passes above and below the horizontal zero or datum line indicates the amount of movement of the car body from or toward the axle. Distances above the zero line show the motion toward the axle, and distances below the line show the motion away from the axle. In Figs. 1 and 2 the distance *Z Y* represents the maximum motion of the car body under each of the two tests recorded, which distance is the sum of the maximum motion toward the axle and the maximum motion away from the axle. The abscissas divided by ordinates into tenths of a second (the entire seconds being marked by heavier lines) indicate the time in which the movements took place. Thus, the point *Y* in Fig. 2 is at 9.45 seconds, while *X* is at 9.68 seconds. Hence, the movement recorded in Fig. 2 by the curve *Z Y* occurred in 0.23 second. Comparing records of Figs. 1 and 2,

(*Continued on page 56.*)

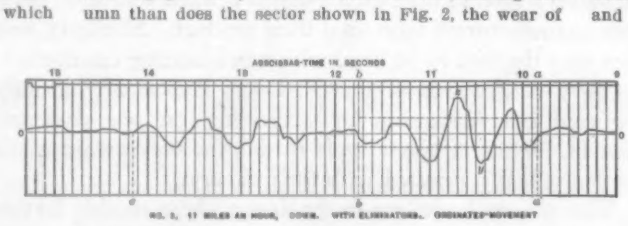


Fig. 1.—RECORD OBTAINED WITH SHOCK ELIMINATORS.

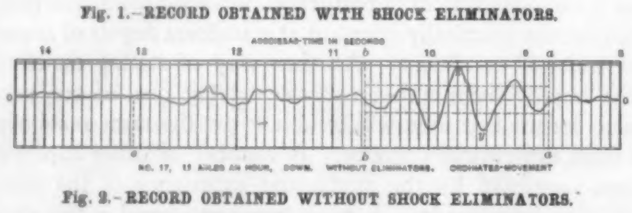


Fig. 2.—RECORD OBTAINED WITHOUT SHOCK ELIMINATORS.

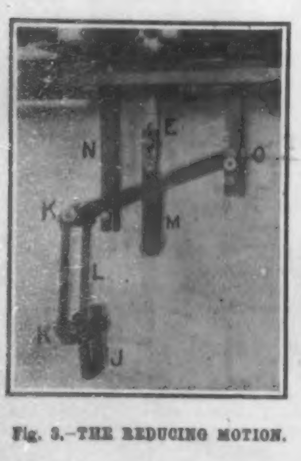


Fig. 3.—THE REDUCING MOTION.

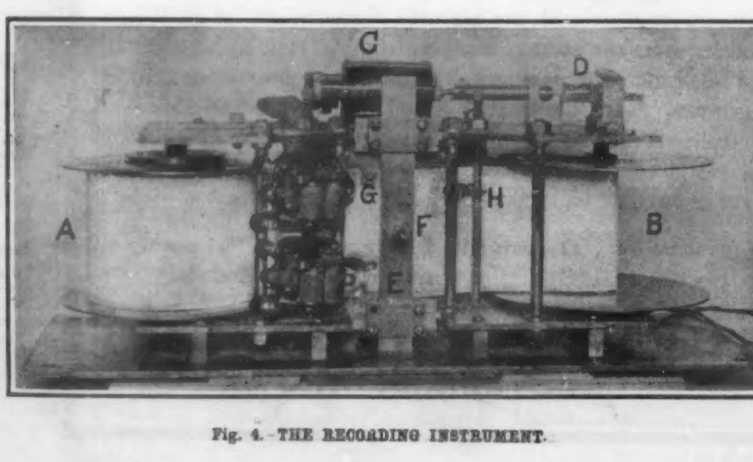


Fig. 4.—THE RECORDING INSTRUMENT.

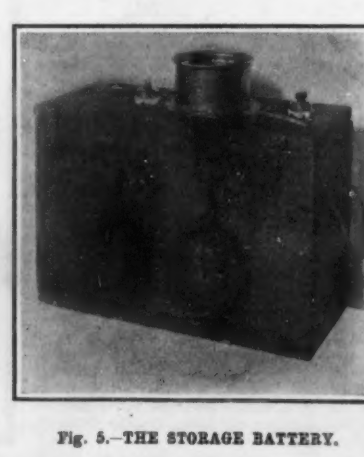


Fig. 5.—THE STORAGE BATTERY.

lamps is furnishing the amperes necessary to light 100 lamps. The voltage required for one lamp is the same as required for 100 lamps if the lamps are in multiple, as lamps are ordinarily arranged on a 100-volt circuit. If the lights were arc lights in series, then the amperes would be the same for 100 as for one lamp, and the volts would vary from lamp to lamp. One lamp would require about 50 volts, and 100 would require 5,000 volts. It is, however, not usual to put more than 50 lamps in series upon 2,500 volts.

(10292) J. F. M. asks: I would like to know if the small dynamo can be run as a motor on a 110-volt circuit, and what changes in winding would have to make for that purpose. A. The small dynamo of SUPPLEMENT No. 161 cannot be run on a 110-volt circuit. It would burn out directly. We have not the winding data for changing this dynamo to 110 volts. You will find such a machine described in Poole's "Designs of Small Dynamos," which we send for $2.

(10293) E. L. W. asks: Will you kindly state in your Notes and Queries column what causes the report made by the cracking of a whip? A. The crack of a whip communicates a shock to the air which is transmitted to the ear, and we hear the sharp, sudden sound.

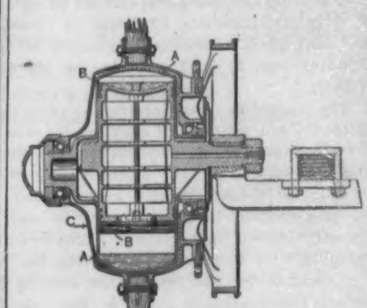
(10294) G. L. S. asks: Will you kindly tell me if I hold a strong horseshoe magnet near a copper wire, say within a half inch, and then pass a powerful current of electricity through the copper wire, will there be any attraction between the wire and the magnet? If I make the magnet stationary, and then hold the wire very close to it, and slack enough for it to readily reach the magnet when the current is sent through it, would they move toward each other, or would there be no change of position at all? If they do attract each other, how strong a magnet, also how strong a current, will be needed to pull this wire say a distance of an inch or a little less? A. If a coil of wire carrying a current of electricity is brought near a powerful magnet, one end of coil will be attracted toward the magnet and the other end will be repelled from it. This is because the coil is itself a magnet and behaves as a magnet does. A straight wire will be very slightly affected by even a powerful magnet. It will be twisted around till its field of force lies with the lines parallel and in the same direction as that of the magnet. It will then move toward the magnet, but not with much force. The energy of a single wire is not great enough to cause it to do so.

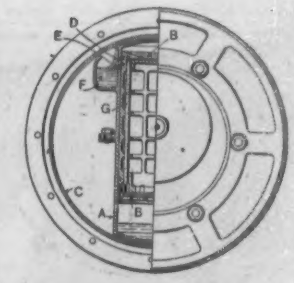
(10295) G. O. V. asks: Will you please let me know what century or year, and where, the Romans first made the day to begin at 12 o'clock and end the next night at 12 o'clock? A minister told me some time ago that he guessed they did it in the fourth century. I want to know sure. A. We think you have been incorrectly advised as to the practice of the Romans in beginning the day at midnight. They did not begin to do this in the fourth century, since they seem always to have begun the day at the middle of the night. Varro, a learned Roman of the time of Cicero, wrote a book which has not come down to us, but which has been quoted by several authors whose works we have. The title of the book was "Concerning Human Affairs." One of the chapters was upon "Days." This chapter is quoted in the "Saturnalia" of Macrobius, Book I., Chap. 3, as also by Gellius in his "Attic Nights": "Men who are born in the 24 hours from midnight to the next midnight are said to have been born upon the same day." By which words it is evident, Macrobius says, "that they divided the observation of the day so that he who was born after sunset and before midnight, that should be his birthday in which that night begins; on the contrary, he who was born in the six later hours of the night should be considered to be born on that day which followed that night." And this, so far as the authorities go, was always the practice of the Romans. The Babylonians reckoned from sunrise to sunrise (Isodorus, "Orig." V. 30), while the Athenians and the Hebrews reckoned from sunset to sunset (Gellius, "Attic Nights," III., 2.) "The same Varro in the same book has written," says Gellius, "the Athenians observe differently, in that they say that all the time intervening from one sunset to the succeeding sunset is one day."

PNEUMATIC STEEL HUB FOR AUTOMOBILE WHEELS.

While the pneumatic tire admirably performs its function of absorbing obstructions and inequalities of a roadbed when these are small, it falls far short in the case of large obstacles and deep ruts and holes. The novel construction illustrated herewith is offered as a remedy for this deficiency. In order to relieve the tire which, as shown by incessant tire troubles, is entirely too delicate a member to be subjected to such rough treatment as it ordinarily receives, an auxiliary cushion is provided at the center of the wheel to take up heavy shocks. This air cushion, which is in the form of a column of air, is placed between the wheel and the axle, so large obstacles can be overriden without lifting the car body. The new construction has been subjected to a thorough test during the last year on a double-chain stock machine weighing about 3,000 pounds with its full complement of five passengers. The wheels, which are of the usual artillery type, 36 inches in diameter, are fitted with solid tires.

The construction of the wheel may be readily understood by reference to the accompanying sectional views. It will be observed that it consists of three essential parts. A vertically-disposed double cylinder, *A*, mounted in ball bearings on the wheel, a hollow piston, *B*, operating within the cylinder and formed integral with the axle, and a hollow hub, *C*, entirely enveloping the piston and cylinder. The car is provided with a small air compressor driven by the engine, which delivers air under pressure to a reservoir or tank provided with a safety





valve controlled from the dashboard. The air from this tank is delivered through a central bore in the axle to the hollow piston. Between the top of the piston and the upper end of the cylinder, an air cushion is provided, which is utilized to produce a forced circulation of oil to the moving parts.

In operation, when an obstruction is encountered by the wheel, the latter is raised, compressing the air between the bottom of the piston and the lower end of the cylinder, while at the top air is drawn through a row of ports, *D*, in the cylinder, and oil is sucked in through a lower row of ports, *E*, from the reservoir, *F*. This oil flows into the concave top of the piston, lubricating the piston rings and guides. On the rebound of the wheel the oil trapped is forced down a tube, *G*, to the lower end of the piston. It escapes past the piston rings, lubricating the latter, and through ports in the lower end of the cylinder drips into the hollow hub. As the latter is rapidly revolving, the oil is carried upward, as shown in Fig. 2, and dashed against the upper end of the cylinder, whence it falls into the oil reservoir, *F*. Thus a complete cycle is established. It is claimed the loss of air and wear of the parts is very small. This wheel is particularly adapted for use on such cars as use compressed air.

A NOVEL REFLECTOR.

The accompanying illustration represents in longitudinal section the Gray-Davis acetylene lamp for automobiles. In order to obtain a light which will answer the dual purpose of being visible at a great distance and which will, at the same time, brightly illuminate the road ahead of the car, a novel arrangement of a concave mirror and convex lens has been adopted. It will be seen that the

(*Continued on page 43.*)

FOOD LOSSES DURING COOKING.

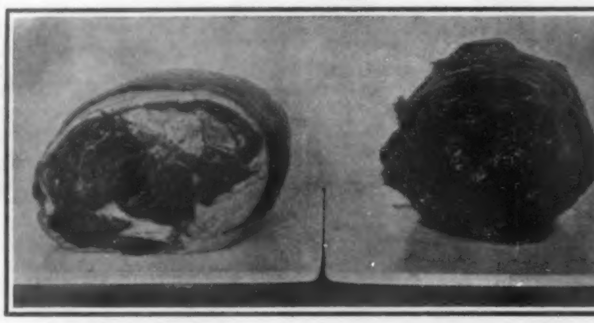
BY H. D. JONES.

With a view to securing accurate data regarding the changes which take place in meat when cooked, and at the same time obtaining information that may tend to lessen the miseries of a nation of dyspeptics, the professors of chemistry at the University of Illinois have been engaged for some years past in an elaborate series of experiments. The object of the work was to study the influence of the cooking of meats upon their digestibility; to determine the nature and extent of the losses which meats undergo during the cooking; to investigate the nutritive value of cooked meats; to study the character of the changes which take place in meats when they are cooked by the various methods, and to observe the influence of cooking upon the flavor and palatability of meats.

From time to time reports have been made to the Department of Agriculture concerning the progress of the experiments, and lately a more exhaustive report has been prepared, which sets forth the results attained during the work carried on by H. S. Grindley, Associate Professor of Chemistry, and Profs. Timothy Mojonnier, W. O. Atwater, and F. F. Trowbridge, at the University of Illinois.

The conclusions were arrived at after experimenting with various methods of cooking, for which the popular names of boiling, pan-broiling, *sautéing*, and roasting are applied by the scientists for want, as they explain, of a more precise nomenclature, which they think should be invented for use in such cases. The scientists found themselves at a loss to define the term "boiling," for instance, in reporting the result of the experiments, for the reason that cooking in hot water at any temperature is called boiling. As the temperature varied in the different experiments, the exhaustive reports made contained the temperature at which the various results were attained, so that the expert could tell whether the meat was cooked by stewing, simmering, or true boiling.

The method employed in the pan-broiling experiments was to cook the meat upon the surface of a medium hot, dry, cast-iron frying pan for the desired length of time, which was recorded in each case. No fat was added to the frying pan either before or during the cooking, but the meat was frequently turned. In the *sautéing* experiments the meat was cooked for fifteen minutes in a small amount of hot lard, the quantity used being sufficient to form a thin layer upon the bottom of the pan. In this case also the meat was frequently turned during the cooking. In the roasting or baking experiments the meat was cooked in a pan in a well-ventilated oven, and the details as to temperature and time of cooking carefully recorded.



Rolled Beef Rib Roast, Cooked and Raw.

In order to obtain exact data concerning the losses during cooking, it was essential to analyze the drippings from the meat, for there is considerable nourishment in dripping, and this is by no means a loss. Therefore, the drippings were carefully weighed, and kept in a dry place for two or three hours until the solid matter had settled. As much as possible of the fat was then poured off, and the remainder filtered, dry, warm filter paper being used, and the operation carried out in a large water oven kept at a suitable temperature. The solid residue from the drippings was cooled and washed several times with ether to remove the remaining fat, and this taken into consideration in the final summing up.

In the boiling experiments the meat was weighed before and after cooking, and the difference was taken as representing the total loss in weight resulting from the process of cooking. The broth was analyzed by cooling it and straining it through a piece of cheese cloth, rendering it free from the coarser particles of solid matter, and most of the fat, which was solid when the broth cooled. The total loss in weight, less the sum of the ingredients found in the broth, was assumed to represent the amount of water removed from the meat in cooking. The cooked meat was then analyzed, and the amount of each nutrient in the cooked meat was added to that in the broth, and the sum taken as the amount of the nutrients in the raw meat. From this amount and the amount in the broth, the percentage loss of each ingredient was calculated.

Proceeding along these general lines, with slight variation to suit the great number of experiments made, the chemists came to conclusions which are summed up in this manner:

The losses in weight when meat was cooked in hot water varied in the individual tests from 10.61 to 50.20 per cent of the total weight of the fresh meat used, the average being 34.35 per cent. The amount of water removed during cooking varied from 18.05 to 68.90 per cent, and averaged 45.07 per cent of the total water in uncooked meat.

The results of the pan-broiling experiments showed that the total loss varied from 23.10 to 35.10 per cent, the average of all the experiments being 30.68 per cent. This was due almost entirely to the removal of water, the average loss of this constituent being 30.52 per cent.

In summing up the *sautéing* experiments, it was found that the amount of water driven off by heat varied from 40.44 to 51.39 per cent, averaging 46.86 of the entire amount contained in the original uncooked meat. The roasting experiments showed that the nature of the loss in this method of cooking is entirely different from that occurring in boiling, *sautéing*, and pan-broiling. In the case of the last three methods of cooking, the greater part of the loss is due to water, but in roasting the main loss is distributed between the water and the fat. In other words, the loss of fat resulting when meat is roasted is much greater than when it is boiled. In the roasting experiments the average loss of water amounted to 17.53 per cent, and the average loss of fat to 9.83 per cent of the total weight of the edible portion of the uncooked meat. In 91 boiling experiments the average loss of water amounted to 30.75 per cent, and the average loss of fat to only 1.21 per cent of the total weight of the edible portion of the uncooked meat.

Beef Round, Uncooked.

Beef Round, Roasted.

The general conclusions arrived at from the series of experiments are summed up as follows:

The chief losses in weight during the boiling, *sautéing*, and pan-broiling of meats is due to water removed by the heat of cooking. In the roasting of meats the chief loss is due to the removal of both water and fat.

The losses of nutritive material in the pan-broiling of meats are very small as compared with the losses which take place in boiling, roasting, and *sautéing*.

Water 4 lb. 4 oz. Fat 3.36 oz. Extractives 2.4 oz. Proteid 0.32 oz. Ash 0.91 oz.

Astonishing Losses in Boiling a 10-Pound Beef Round.

Water 1 lb. 7 oz. Fat 6.4 oz. Extractives 0.22 oz. Proteid 0.06 oz. Ash 0.10 oz.

Nutriment Lost in Roasting 10 Pounds of Beef.

FOOD LOSSES DURING COOKING.

When beef was cooked in water in these experiments, 3.25 to 12.67 per cent of the nitrogenous matter, 0.60 to 37.40 per cent of the fat, and 20.04 to 67.39 per cent of the mineral matter of the original uncooked meat was found in the broth. This material is not a loss if the broth is utilized for soup or in other ways.

When meat is *sautéed*, 2.15 per cent of the nitrogenous matter and 3.07 per cent of the ash occurring in the uncooked meat were taken up on an average by the fat in which the mea' was cooked, while the cooked meat contained 2.3 times more fat than before cooking.

When the meats were roasted, 0.25 to 4.55 per cent of the nitrogenous matter, 4.53 to 57.49 per cent of the fat, and 2.47 to 27.18 per cent of the mineral matter present in the uncooked meat were found in the drippings.

Beef which has been used in the preparation of beef tea or broth has lost comparatively little in nutritive value, though much of the flavoring material has been removed.

In the boiling of meats, the fatter kinds and cuts, other things being the same, lost less water, nitrogenous and mineral matter, but more fat than the leaner kinds and cuts.

In cooking meats by boiling, *sautéing*, pan-broiling, and roasting, the losses increased in proportion to the degree of cooking. In other words, the longer the time and the higher the temperature of cooking, other things being the same, the greater the losses resulting.

As a rule, the larger the piece of meat cooked by the methods of boiling and roasting, the smaller were the relative losses.

The experiments indicate plainly that different cuts of the same kind of meat behave very differently as regards the amount and nature of the losses which they undergo when cooked in hot water.

PHOTOGRAPHS WITH BAS-RELIEF EFFECTS.

BY GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

Pictures of bas-reliefs owe their remarkable appearance to a peculiar distribution of light. They lack the contrasts which result from differences in distance. One side is sharply illumined directly and by light reflected on the background; on the opposite side a shadow, cast on the same background, increases the degree of the relief. When these modifications are made in any drawing, relief effects are the result. I devised and tried various methods for producing these while printing photographs, by the superposition of two negatives. These attempts were fruitless, but I obtained better results by the superposition, under certain conditions, of a negative and a transparent positive. The bas-relief pictures which illustrate this article were made by that process with ordinary photographs; amateurs who are familiar with the simplest photographic operations can easily make similar or better pictures. Glass plates cannot be used for both the negative and the positive transparent mediums; the printing is not done, as usual, with the film facing the paper, and, owing to the appreciable thickness of the glass, the image would be blurred. If the picture is small, as in the case of an ordinary portrait, a positive film may be used with a glass negative. If a larger picture is desired, this method will fail, as the positive film contracts during the developing process, and after it no longer coincides with the negative, except over a small area. The best results are obtained when the following process is used:

Select a fairly good negative plate, and make a positive glass transparency with it. Then, with the same negative plate, make a positive film, and with the positive plate make a negative film. Both films having gone through the same baths will contract equally, after being printed, and then their coincidence will be perfect. When developing the positive film, see that it be not darker and more strongly contrastive than the negative. If such were the case, the final printing would bring out an intaglio effect instead of a bass relief. When the films are dry, place them in the printing frame so as to get perfect coincidence. As the negative brings a shade behind every light of the positive, the transparency is flat, that is, almost without contrasts. Move one film a trifle diagonally, so as to destroy slightly the coincidence. Intense lights and deep shadows will suddenly be cast on opposite sides of every relief or hollow part. Keep the film in that position with one hand, and with the other place a sheet of sensitized paper behind it. Print in the direct light of the sun, without interposing a ground glass.

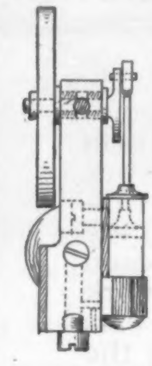
These Two Relief Effects Were Obtained by Printing from Superposed Positives and Negatives.

Photographs of the Above Subjects Made in the Usual Way.

PHOTOGRAPHS WITH BAS-RELIEF EFFECTS.

THE SMALLEST STEAM ENGINE ON EARTH.

THE SMALLEST ENGINE EVER MADE.



PLAN OF THE ENGINE.

What is perhaps the smallest stationary engine ever constructed has been recently completed at his shop on Yonge Street by Thomas H. Robinson, watchmaker, of Toronto, Ontario. Smaller than a common housefly, it slips easily into a "22 short" empty cartridge with plenty of room to spare. It weighs complete just 4 grains troy. This is 120 engines to the ounce, 1,920 to the pound, and 3,840,000 to the ton. The horse-power is 1/498,000 part of a horse-power, and the speed is six thousand revolutions per minute. The vibrating piston rod when running at this speed emits a sound like that produced by a mosquito. The bore of the cylinder is 3/100 of an inch; the stroke is 1/32 of an inch. The cylinder and piston rod, shaft and crank are of steel. The engine bed and stand are of gold. The balance wheel, which has a steel center and arms, with gold rim, weighs 1 grain, and measures 3/16 of an inch in diameter. The shaft runs in hardened and ground steel bearings fitted to the gold bed.

Seventeen pieces were used in making the engine, which is mounted on an ebony stand, inside of which are brass connections, which convey the compressed air used to operate it to the hollow base of the engine. It was exhibited by request before the Canadian Institute in Toronto recently. When running no motion is visible to the unaided eye, but by means of magnifying glasses and lantern slides, which showed the construction, an examination was made, and the opinion freely expressed that the engine is the fastest of its size on earth. The calculations of both speed and horse-power were made by Prof. C. A. Chant, of the Physical Department of Toronto University.

Production of Gas, Coke, Tar, and Ammonia.

A report on the production of gas, coke, tar, and ammonia at gas works and in retort coke ovens during 1905 has been prepared by Mr. Edward W. Parker of the United States Geological Survey and is now ready for distribution. It is supplementary, in a measure, to the reports on the production of coal and the manufacture of coke, and is made in response to a demand from producers of gas and coke and the by-products of tar and ammonia, for statistical information on these subjects.

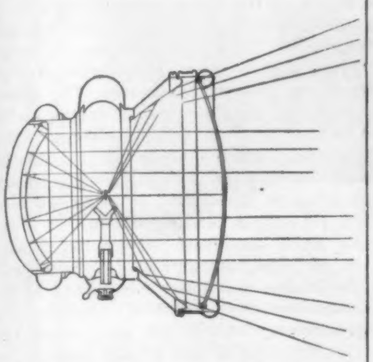
The present report includes, in addition to the statistics of the production of gas, coke, tar, and ammonia at gas works and in by-product coke ovens, a statement of the production of the quantity of gas and tar produced at water-gas works using crude oil for enriching purposes. These statistics have not been considered in any of the preceding reports. At some of the gas houses oil is used with the coal in the production of gas, but the entire production is included in the statistics of coal gas.

The total quantities of these products in 1905 was 40,454,215,132 cubic feet of gas (not including that lost or wasted) 5,751,378 short tons of coke, 80,022,043 gallons of tar, 46,986,268 gallons of ammonia liquor (equivalent to 22,455,857 pounds of anhydrous ammonia), and 38,663,682 pounds of ammonia sulfate, against 34,814,991,273 cubic feet of gas, 4,716,049 short tons of coke, 69,498,085 gallons of tar, 52,220,484 gallons of ammonia liquor (equivalent to 19,750,032 pounds of anhydrous ammonia), and 28,225,210 pounds of ammonia sulfate in 1904. The total value of all these products in 1905 was $56,684,972 against $51,157,736 in 1904.

Oil and Water Gas.—Returns were received from 477 oil and water-gas producing companies, and these show that the total production of water gas in 1905 was 82,959,228,504 cubic feet. Of this quantity 5,547,203,913 cubic feet, or 6.7 per cent, were lost by leakage, etc., leaving 77,412,024,591 cubic feet as the net production obtained and sold. As the quantity of gas made and sold at coal-gas and by-product coke oven works was 40,454,215,132 cubic feet, it appears that the consumption of water gas, and gas made from crude oil was nearly twice as much as that made from coal. It also appears that while the average price of coal gas in 1905 was 81.4 cents per 1,000 cubic feet, that of oil and water gas combined was a fraction of a cent in excess of $1 per 1,000 cubic feet. Still further comparison shows that whereas 66 per cent of the production of coal gas was sold as illuminating gas, 77 per cent of the combined production of oil and water gas was used for this purpose.

An American metallurgist states that plain carbon manganese steel, with an addition of 0.25 per cent of vanadium, had its tensile strength raised 65 per cent and the elastic limit 68 per cent, without in any way impairing the structure to withstand the regular physical tests. While the same carbon manganese steel with 3.34 per cent of nickel added, showed a tensile strength of 94,528 pounds per square inch and an elastic limit of 73,024 pounds per square inch, by the addition of 0.25 per cent of vanadium the tensile strength was increased 61 per cent, which was equivalent to 152,678 pounds per square inch, and the elastic limit was raised by 64 per cent, equivalent to 112,539 pounds per square inch, and gave an elongation in 2 inches of 26 per cent and a contraction of area of 32 per cent.

burner is placed at the principal focus of the concave mirror, so that the rays of light after having been reflected will emerge from the lamp in a pencil composed of parallel rays only. The beam of light thus produced brightly illuminates the road, and clearly shows obstacles and depressions. The other beam of light consists of a divergent pencil, and is pro-



A DOUBLE RAY ACETYLENE, WHICH CAN BE SEEN AT A CONSIDERABLE DISTANCE AND WHICH ALSO ILLUMINATES THE ROAD.

duced by first causing the rays from the burner to strike a cylindrical mirror, by which they are reflected through the convex lens at the front of the lamp. As the diagram indicates, the rays are widely scattered, so that they can be seen at a considerable distance.

IMPROVEMENTS IN THE WHITE STEAM TOURING CAR.

The latest model White touring car has been increased in size and power, so that it is now one of the largest and most luxurious automobiles built in America. The increased power of this machine has been obtained both by increasing the size of the engine and generator, and by increasing somewhat the mean steam pressure by means of a thermostatic regulator, which always assures a pressure of 600 pounds. By the addition of a simple feed-water heater, consisting of a short coil of pipe placed between the water tank and generator and surrounded by the exhaust pipe, the efficiency of the power plant has been further increased by about ten per cent. The feed-water heater not only supplies the water to the generator at a higher temperature, but it also increases the efficiency of condensation.

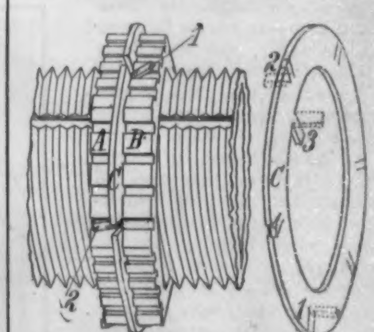
Another radical departure in the new White cars is the location of the gasoline tank in the rear of the car, behind the rear axle. The tank is raised several inches above the axle, so that should the former ever strike obstructions, the tank will be protected. The front axle is of the tubular type, as it is claimed that both theory and practice show that an axle of this type, when properly designed, will best withstand both vertical and horizontal strains. The water tank has been moved to a position under the floor on the left-hand side of the car, where the gasoline tank was formerly located. This tank is provided with a suitable strainer, to stop any oil from passing from the condenser into the tank.

As the new White car is capable of increased speed, and as it is built heavier to withstand the road strains, every part of the frame and running gear has been considerably strengthened. The car is provided with larger and heavier wheels, brakes, and tires, and its every part has been designed upon a new standard of size and strength, which is more than proportionate with the increase in power. A compound steam engine of 3 and 6-inch bore by 4½-inch stroke is used as heretofore. The car is also provided with a disconnecting clutch, so that the engine can be run and warmed while the car is standing. A lower speed can also be thrown in, should the car get stuck in a mudhole, or should there be any occasion for a decided increase in power.

The new touring car can be fitted with a Pullman type of body, in which there are two revolving chairs in the tonneau (this type is shown in the illustration on page 33), or it can be fitted with a shorter ordinary touring car body, having extra space on the rear of the frame for carrying baggage. The latter body has ample room for carrying three passengers on the rear seat. It is also considerably lighter than the body which we illustrate.

AN INGENIOUS LOCKING DEVICE.

A locking device that will absolutely preclude the coming loose of nuts is essential for automobile construction. One of the neatest and simplest devices of this kind which we have seen, is found on the Stoddard-Dayton automobile. The arrangement consists of a locking washer, *C*, having lips such as 1, 2, 3 on its inner and outer surfaces, and which is placed between the usual nut and lock nut that are generally used. The nuts have transverse grooves on their faces for the purpose of receiving the outer lips, such as 1-2, of the washer. After the nut, *A*, has

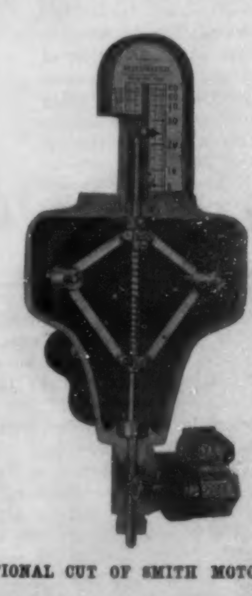


A SIMPLE AND EFFECTIVE LOCKING DEVICE.

been set and jammed tightly, the locking washer is slipped on the shaft with its inner lip, 3, in a groove in the latter, and with an outer lip, such as 2, bent over into one of the notches of *A*. The lock nut, *B*, is then set up, and another lip of *C*, such as 1, is bent over into one of the notches of *B*. The arrangement, as can be seen, makes it impossible for either nut to turn with respect to the other, or to the shaft.

A SIMPLE TYPE OF AUTOMOBILE SPEEDOMETER.

Among the many kinds of speedometers now on the market, one of the simplest and most positive that we have seen is that made by the R. H. Smith Manufacturing Company, of Springfield, Mass. This motometer, as it is called,



SECTIONAL CUT OF SMITH MOTOMETER.

consists of a vertical spindle driven through a flexible shaft from the wheel of the automobile, and carrying upon it weights similar to those of an ordinary flyball governor, so arranged that the vertical movement secured by the pivoted

(Continued on page 47.)

SOME MODERN INVENTIONS WHICH ARE ANCIENT HISTORY.

BY RENÉ BACHE.

Every now and then it is discovered that some extremely "modern" invention is in reality exceedingly old. For example, the safety-pin, far from being a novelty, or even of recent origin, is decidedly ancient—a fact made certain by the finding of a great many such pins, fashioned exactly like those of to-day, in old Roman and Etruscan tombs, dating back to a period a good deal earlier than the birth of Christ.

The safety-pin, in truth, was an article of common use in Italy long before the Roman empire attained the height of its glory. Some of them were exactly like those of to-day, utilizing the familiar principle of coiled spring and catch; but the material of which they were made seems always to have been bronze. They took on a development, however, far more remarkable than our modern safety-pins, many of them being quite large affairs, ten inches or so in length, and hollow, as if designed to be attached to the gown in front, and possibly to contain something or other—conceivably flowers. Not infrequently they were ornamented with gems.

Another ancient invention was the collar stud. It is true that the ancient Romans did not use buttons to fasten their garments, but for this very reason safety pins were more urgently required; and the latter seem to have been supplemented by studs of bronze, which were in shape exactly like those of to-day. Of course, people in those times wore no collars; but the little contrivance in question was utilized in other ways. Probably—and, indeed, the assumption is not a rash one—it had in that early epoch the same habit as now of rolling under a piece of furniture on slight provocation, for the purpose of eluding observation and pursuit, with the usual perversity of inanimate objects.

Of all modern inventions, none seems to belong more typically to the present day than the so-called McGill paper fastener—the small brass contrivance used to fasten a number of sheets of paper together. Yet (though it has been patented) it was well known more than two thousand years ago, being used by the soldiers of Rome as an incidental of their costume. The belt of thin copper worn by the ancient legionary was fastened to a strip of cloth, for lining, with a series of little bronze clamps exactly like the paper fastener in question.

The Smithsonian Institution, at Washington, has got together a very interesting collection of such ancient inventions—one of the specimens shown being the belt of an ancient Roman soldier, which exhibits the application of the contrivance described. Among other objects belonging to the same category are thimbles two thousand five hundred years old. They are of bronze and their outer surfaces show the familiar indentations for engaging the head of the needle. Indeed, these thimbles are much like modern ones, barring the fact that they have no tops to cover the end of the finger. For that matter, however, many thimbles of to-day are topless.

The women in those days had bronze bodkins, made just like those in use now, and for toilet purposes they employed small tweezers of a pattern that has not been altered in two thousand years. To hold their hair in place, they had not hit upon the notion of bending a wire double; but they used for that purpose straight bronze pins, made exactly like modern hatpins, with big spherical heads. It is from this early type of hairpin, in truth, that the hatpin of to-day is derived. Mayhap the ancient Roman virago, when aroused to rage, plucked an improvised dagger from her back-hair and employed it vigorously.

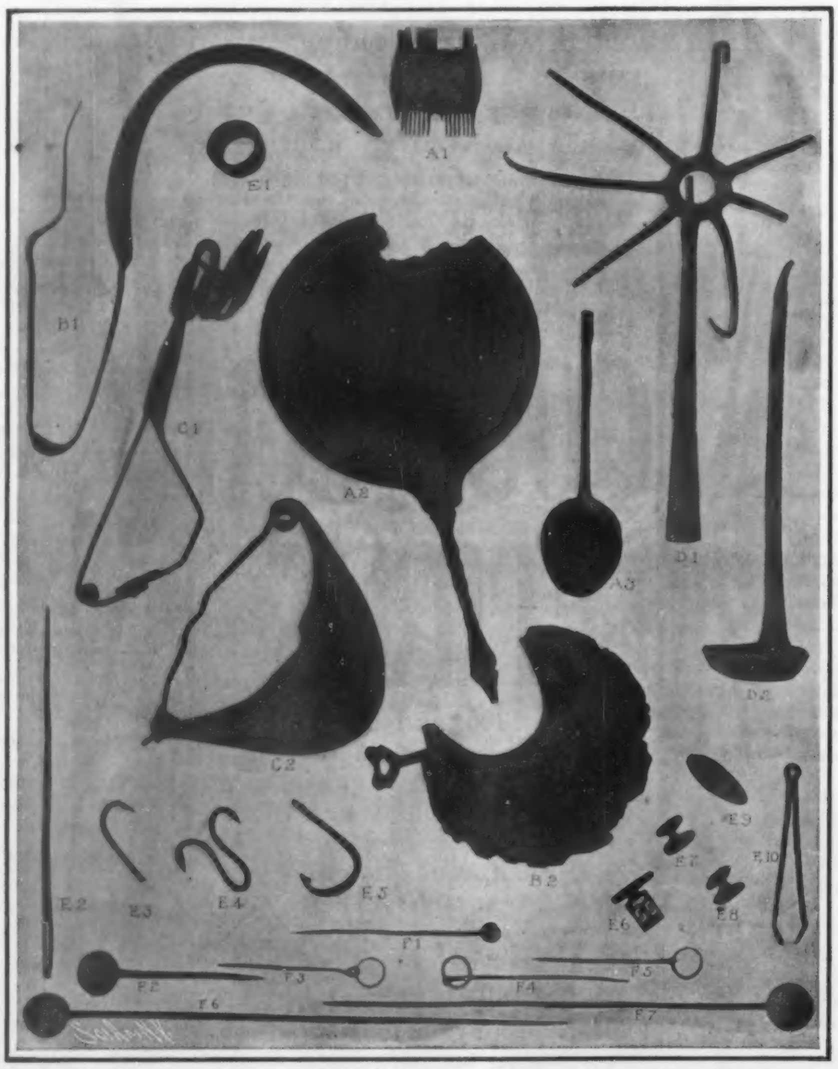
In the collection referred to is a number of fishhooks, not less than three thousand years old, obtained from ancient Swiss lake dwellings. They are of bronze, and in shape are exactly like the most improved modern fishhooks. They have the same curves and the same barbs, with a similar expansion at the top of the shank for the attachment of the line. Barring the metal of which they are composed, they might have been made yesterday. Other curios, from the old Etruscan tombs, are strainers, ladles, spoons, and knives of bronze. Such articles, as well as bronze daggers, and other weapons and utensils, were cast most commonly in molds that were carved out of hard stone, a pair of stones being required to produce the object, which was afterward polished and otherwise elaborated. Among the most interesting of the contrivances for the toilet is a fine-tooth comb of ivory, which in shape is precisely like the fine-toothed combs of to-day.

Of course, the gentleman of ancient Rome was obliged to shave himself, unless he chose to wear a beard, and for this purpose he used a razor which must have made the operation decidedly severe. It was not at all like modern razors, but (as shown by a specimen in the Smithsonian collection) was of bronze and somewhat like a small sickle, very broad in the moon-shaped blade and with a handle rigidly attached.

It is well known that the ancient Romans knew how to plate one metal with another. They made, and some of them (like Cicero) wore, false teeth. The manufacture of glass was entirely familiar to them, and that they knew the modern method of mending broken pots by means of rivets has been shown by the discovery of many pieces of pottery thus restored. It seems rather surprising that they did not acquire the art of printing with movable types, inasmuch as they came so very near to it. They had wooden blocks carved with words in reverse, by means of which they stamped words on pottery while the latter was as yet unbaked and soft.

Every Roman gentleman had a latch-key which fitted the door of his dwelling. It was attached to a finger-ring, so that it could not easily be lost, and would always be ready for convenient use, no matter what the hour or the condition of the owner.

Naturally, the Roman damsel or matron had to have something in the way of a looking-glass, and it is odd to find that her hand mirror was precisely of the most fashionable modern shape. It was of polished bronze, because the art of silvering glass to make it serve as a reflector was then unknown. At that epoch people must have had a much less vivid idea of what they looked like than they have nowadays, and it is easy to imagine that a looking-glass such as one could buy in 1906 would have been worth a considerable fortune in Rome two thousand years ago.



A1, Fine-tooth comb; A2, hand mirror; A3, spoon; B1, razor; B2, kitchen utensil; C1-2, safety pins; D1, instrument for removing meat from an oven; D2, ladle; E1, ring; E2, needle; E3-5, fish-hooks; E 6, door-key; E 7-8, collar-buttons; E9, bodkins; E10, tweezers; F1-7, hairpins.

SOME MODERN INVENTIONS WHICH ARE ANCIENT HISTORY.

Kelvin on Wireless Telegraphy.

The following letter from Lord Kelvin appeared in the London Times:

Sir: The letters of Prof. Silvanus Thompson and Sir William Preece in the Times of yesterday will, I am sure, interest many of your readers who are unable to follow the very important questions of international policy at present under consideration by the Berlin Congress on wireless telegraphy. The statement of historical facts and of scientific truths which they contain go far toward a complete history of the origin of one of the greatest wonders and triumphs of science in the nineteenth century—wireless telegraphy—due to the scientific discoveries of many workers and practically realized by Mr. Marconi in 1896. Sir Oliver Lodge's Royal Institution lecture on Friday, March 8, 1889, on "The Discharge of a Leyden Jar," was full of the origins of wireless telegraphy. It included a startling case of "telefunken," discovered by some of the audience, between gilt patches on the wall of the lecture room. The lecturer gave a quotation from "Scientific Writings of Joseph Henry" (Vol. I., page 203), of which the following is a part describing electrical experiments made by him about 1830, when he was Professor of Mathematics and Natural Philosophy in Albany: "A remarkable result was obtained in regard to the distance at which inductive effects are produced by a very small quantity of electricity. A single spark from the prime conductor of the machine of about an inch long, thrown on the end of a circuit of wire in an upper room, produced an induction sufficiently powerful to magnetize needles in a parallel circuit of wire placed in the cellar beneath at a perpendicular distance of thirty feet, with two floors and ceilings, each fourteen inches thick, intervening."

This is the nearest approach to wireless telegraphy given to the world before practical proof of electrical waves through ether and of their wonderful energy-carrying quality was given in Hertz's magnificent experiments inspired by Helmholtz. Lodge himself made in 1894, as described in Prof. Thompson's letter in the Times of yesterday, very important steps toward the wireless telegraphy publicly realized by Marconi two years later. Lodge had got signals successfully through a distance of 150 yards; Marconi, in 1896, had signals through three-quarters of a mile; and very soon after, with aid given by our post office, this was extended to nine miles across the Bristol Channel. As early as the beginning of June, 1893, I was taken by Lord Tennyson to Marconi's telegraph station at Alum Bay, in the Isle of Wight, then in successful wireless communication with Bournemouth; and I had the great pleasure of sending messages through fifteen miles of ether, and on by our postal land telegraphs to Sir George Stokes at Cambridge and other friends in England and Scotland. I believe that up to that time, or at all events up to the time of Marconi's success across the Bristol Channel, there had been no other practical advance upon Lodge's wireless telegraphy through 150 yards.

Sir William Preece tells us that the post office had been actively engaged in developing wireless telegraphy since 1884, and that in 1895 communication between Oban and Mull was successfully made. This experiment was carried out by Sir William Preece himself. It was by induction between parallel lines of telegraph wire on the two coasts and was practically valuable because by it the communication was kept up until the ruptured cable between the island and mainland could be repaired. That was the best that could be done in 1895. It illustrates the greatness of the boon brought by Marconi a year later.

American Association for the Advancement of Science.

NEW YORK MEETING, DECEMBER 27, 1906, TO JANUARY 1, 1907.

BY WILLIAM H. HALE, PH.D.

The meeting of the American Association for the Advancement of Science held at Columbia University, New York city, December 27, 1906, to January 1, 1907, is believed to have been the largest gathering of American men of science, covering all departments, that has ever convened, and the proceedings were of interest and importance commensurate with the occasion. The official register of 928 names must be supplemented by several hundred members of the nineteen affiliated societies.

The great historical feature of the occasion was the unveiling of busts of American men of science, presented to the American Museum of Natural History by Dr. Morris K. Jesup, whose previous benefactions to this museum were so munificent. This ceremony was held at the museum on Saturday afternoon, December 29, before a vast and brilliant assembly. Owing to the illness of J. Pierpont Morgan, Dr. Henry F. Osborn presided. Although the donor was present, the address of presentation on his behalf was made by Dr. H. C. Bumpus, director of the museum, and the address of acceptance by ex-Ambassador Joseph H. Choate. Brief memorial addresses were made in reference to each of the scientists as follows: Benjamin Franklin, by Dr. S. Weir Mitchell; Alexander von Humboldt, a letter from Baron Speck von Sternberg, of the German Embassy at Washington; John James Audubon, by Dr. C. Hart Merriam; John Torrey, by Dr. N. L. Britton; Joseph Henry, by Dr. R. S. Woodward; Louis Agassiz, by Director Walcott of the U. S. Geological Survey, and letters from Rev. Dr. E. E. Hale and Dr. F. W. Putnam; James Dwight Dana, by Dr. A. T. Hadley; Spencer Fullerton Baird, by Dr. Hugh M. Smith; Joseph Leidy, by Dr. Wm. K. Brooks; and Edward Drinker Cope, by Dr. H. F. Osborn. Humboldt was included in this list because of the great work done by him in America.

Another feature which will make this meeting memorable was the organization of a new section of education, to be known as Section L. This, however, is simply a recognition of the increasing affiliation of the American Association for the Advancement of Science with educational work.

Among the persons present at the meeting was Dr. William P. Blake, who was a member of the old Association of American Naturalists and Geologists, but not present at the meeting in 1848 when the older association gave place to the present one.

At the general session a resolution was passed providing for the protection of the Appalachian forests.

A novel and very interesting feature of the meeting was the reception and exhibition of recent progress in science by the New York Academy of Sciences in conjunction with the American Museum of Natural History, comprising several thousand exhibits in eighteen departments of science. Out of such a mass of detail almost any attempt at selection seems invidious; yet I may mention an ingenious rotating apparatus to show the movement of intestines and stomach during digestion, prepared from photographs of the intestines of a small animal taken by the X-rays, after feeding the animal a solution of bismuth, which rendered them opaque enough to be photographed; an ingenious and novel gyroscope, perplexing indeed to explain; casts showing cancer in successive stages of cure by radium, and a photograph of radium spilled on a carpet, made by the radium itself on a sensitive plate, and thus enabling the radium to be recovered by discovering its exact location. An electric bulb with filament of a compound of silicon and carbon glowed with unrivaled brilliancy, and at great economy of electricity.

Of the many joint meetings of sections and affiliated societies, the most important was that of the American Association for the Advancement of Science and the American Society of Naturalists with its affiliated societies for the discussion of the Biological Significance and Control of Sex, which was treated by several speakers from both botanical and zoological points of view. As regards pre-natal control of sex, the symposium was almost entirely destructive of previous theories. The consensus of opinion was that no means of controlling the sex of offspring can be relied on, so far as already known.

The annual address of the retiring president, Dr. C. M. Woodward, was on "The Science of Education."

Of the vice-presidential addresses I was able to hear only two, those of Dr. George N. Rice on "The Contributions of America to Geology," and of Dr. Irving Fisher on "Why the Laissez-Faire Doctrine Failed." Dr. Rice showed that these contributions were of much importance along several lines, beginning with the theory of continent building. The old notion of alternating regions of ocean and continent leading to a belief in some lost Atlantis has given place to the knowledge that the present continental areas are in fact primeval, though of course varying greatly in areas and in height of emergence of portions and depth of submergence of portions from age to age.

Dr. Fisher, while pointing out that the reaction from the Laissez-Faire or let-alone system in economics was liable to lead to undue socialistic theories, indicated the fallacy of that system in both its postulates. It is neither true that men in general can select that line of conduct which is in all respects most for their own interest, nor that such conduct does conduce in all cases to the general welfare of society.

Dr. H. B. Ward, in his vice-presidential address to Section F, explained why some persons who drink water containing typhoid germs escape, while others are infected. The germ does not enter the system if the intestinal lining is intact, but if parasites bore into this lining the typhoid enters there. Other parasites destroy the coagulability of the blood, causing bleeding piles; others again produce swellings of the intestines, which impede the progress of the contents and serve as points of deposition of solid matter, making a sort of pearl in the intestine—which of course is where nobody wants to wear pearls of any sort.

The meeting at the new site of the College of the City of New York, corner of Amsterdam Avenue and West 138th Street, was one of the most interesting features of the entire session. Few even in New York know what a group of palaces, costing altogether six million dollars, is here nearing completion. This meeting was given up to Niagara Falls with two addresses, one by Dr. John M. Clark on the effort to save Niagara; the other by Dr. C. F. Chandler on the industries of Niagara, with an exhibition of some of the wonderful products of the various manufactures there, notably aluminium. Some account of the Goldschmidt process of welding by "thermite," which is powdered aluminium mixed with iron oxide; and after showing many other electrolytic products, he closed with bare mention of nitrates or plant food from the atmosphere, which when it can be done cheaply will increase the production of the soil.

The foundation of the Entomological Society of America was another important result of the meeting. The lecture before this new society by Dr. W. M. Wheeler on "The Polymorphism of Social Insects" was limited to discussion of ants, omitting termites, bees, and wasps. The variety of forms developed in members of the same kind of ants was indeed surprising. On the one hand we saw on the screen a mother ant one thousand times as large as her worker progeny. This is a species that infests the nests of termites; the workers must be minute in order to traverse the narrow galleries into the storehouse of the termites which they despoil. The other were parasitic ants where the mother was actually smaller than her worker brood. This is because the parasitic larvæ are so overfed by their deluded hosts, who blindly suppose them to be extra fine grubs of their own family till the ruthless invaders at last get control and destroy the original possessors.

By far the greatest array of papers was presented in the Chemical Section and the American Chemical Society, and of these I must make special mention of two on the origin of radium. Prof. Bolton, of Yale, and Prof. Rutherford, who read these papers, agree that radium is derived from actinium. There are probably many steps in the evolution of radium, beginning with uranium; one of these steps is actinium.

The Geological Society of America and the section of Geology and Geography of the American Association for the Advancement of Science also had a large programme, and continued their session for reading papers even during the unveiling of busts of men of science in the same building.

It should be said in general that much interesting material was presented in every one of the sections, far exceeding space available here to discuss.

Early English Gunpowder.

A bucket containing bullets and gunpowder has been discovered in the roof of Durham Castle, where it is believed to have been walled up about the year 1641, when the castle was being prepared to withstand a Scottish raid. The bullets are molded spheres of two sizes, and, according to the analyses of Messrs. Silberrad and Simpson, consist of a little over 99 per cent of lead, with iron and silver, and traces of bismuth, arsenic, and antimony. The gunpowder is not granulated like that of the present day, and was evidently prepared by simply mixing the ingredients. It contains about 1 per cent of moisture, and the proportion of the constituents calculated on the dry powder is practically identical with that of the black gunpowder of to-day, viz., niter, 75 per cent; carbon, 15 per cent; and sulphur, 10 per cent. It is pointed out by Messrs. Silberrad and Simpson that this is a remarkable fact, since the gunpowders made in England at that time contained a considerably larger amount of sulphur. The only gunpowder with the modern proportions in use in the seventeenth century was Prussian musket powder, and hence it is suggested that the Durham powder was probably of Prussian origin.—Knowledge.

Correspondence.

The Hurricane of September 26 and 27, 1906, at Pensacola.

To the Editor of the Scientific American:

Believing that such peculiar results of the hurricane that visited this place September 26 and 27 will prove of interest to your readers, I take the liberty of writing you.

The hurricane blew from twelve to fourteen hours, and the leaves upon the trees that were not blown down were either blown off or whipped until the life was out of them, so that the live oak trees and other evergreens presented the appearance of having been scorched with fire. Immediately after the hurricane, all trees and shrubs put out new leaves like unto spring time. In a few days peach trees were in full bloom, then followed pear trees and plum trees. In the course of two or three weeks the pecan orchards were in full bloom. All kinds of lilies put up new shoots, and have been in bloom ever since. Roses and other shrubs have also been blooming just the same as in March and April. For the past two or three weeks mulberry trees have been laden with ripe fruit. Fig trees put out new leaves, and are now in full fruit. Of course, it is not probable that any of these fruits aside from the mulberry will ever reach maturity, as this is the time of the year that occasional frosts occur.

Pensacola, Fla. Charles H. Bliss, Mayor.

Gun Erosion.

To the Editor of the Scientific American:

In your issue of November 24 Mr. J. R. Wilkinson cites some facts bearing on the erosion of rifle guns as detrimental to their effective use. I would bear witness to some facts on the other side of the question.

During the late winter or early spring of 1863 the 1st Indiana Heavy Artillery were armed with 30-pound Parrott rifles, and during the following June and July took active part in the siege of Port Hudson, lasting forty-two days, firing every day and a large per cent of the nights. During this engagement we were supplied with two kinds of shells, one with a brass collar or band, that was intended to swell by the impact to fill the rifles and give it the whirl necessary to prevent "tumbling." I do not recall the name of the shell.

The other was the Hotchkiss, a perfectly plain shell not provided with anything of the kind, and "tumbled" about every third or fourth shot, and were promptly condemned and never after used. These guns were followed by the same men through many engagements to the close of the war in April, 1865.

The last work was at the siege of Mobile, April, 1865, where effective work was done at a distance of 3,600 yards, and at 3,000 yards four of the same guns drove a fleet of four ironclads of the enemy from the Tensas River in four hours' firing.

For accurate and effective artillery firing these 30-pound Parrott guns were just as reliable, after nearly three years of constant campaigning, and throwing tons of shot and shell, as they were at the first fire.

The shell never "tumbled," and I presume there was no erosion.

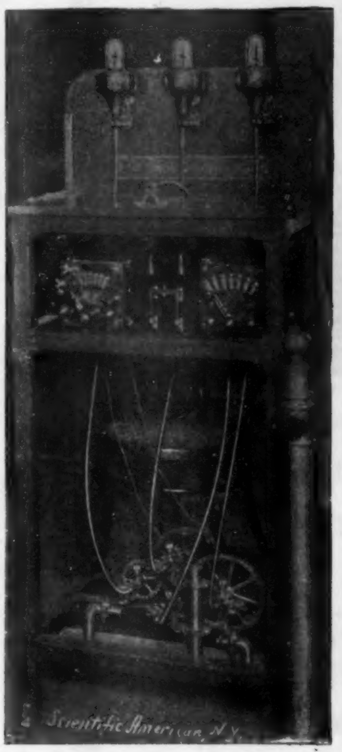
Rufus Dooley,
Ex-Artillerist Army of the Gulf.
Rockville, Ind., November 26, 1906.

Official Meteorological Summary, New York, N. Y. December, 1906.

Atmospheric pressure: Highest, 30.71, date 19th; lowest, 29.64, date 6th; mean, 30.12. Temperature: Highest, 57, date 15th; lowest, 8, date 24th; mean of warmest day, 49, date 15th; coldest day, 14, date 24th; mean of maximum for the month, 39.6; mean of minimum, 25.8; absolute mean, 32.7; normal, 34; deficiency compared with mean of 36 years, —1.3. Warmest mean temperature for December, 42, in 1891. Coldest mean, 25, in 1876. Absolute maximum and minimum for the month for 36 years, 68 and —6. Average daily excess for the year 1906, +1.6. Precipitation, 3.53; greatest in 24 hours, 0.98; date, 30th and 31st; average of the month for 36 years, 3.40. Excess, +0.13; deficiency for the year 1906, —2.77. Greatest precipitation, 6.66, in 1884; least, 0.95, in 1877. Snow 0.5. Wind: Prevailing direction, N. W.; total movement, 10,772 miles; average hourly velocity, 14.5; maximum velocity, 58 miles per hour, date, 7th. Weather: Sleet, 9th, 10th, 16th. Fog: 10th, 20th, 21st, 29th.

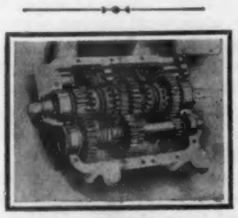
The cost of copper refining by electricity has been reduced greatly in recent years in the American refineries by the introduction of mechanical devices for casting the anode slabs of crude copper and for charging and discharging the vats. According to an article by Mr. John B. C. Kershaw in Cassier's Magazine, the expenditure on hand labor has thus been greatly reduced, and the time during which vats are laid off for recharging and cleaning has been curtailed. The current density used has also been greatly increased by the use of improved methods of circulating the electrolyte, and by the addition of a very small percentage of hydrochloric acid to the copper sulphate solution.

lever arms of these weights, as they lengthen out and approach each other under the action of centrifugal force or gravity upon the weights, is communicated directly to an indicating stem carrying pointers that travel over the scales of the instrument. Thus, the action of centrifugal force upon the balls of the governor part of the apparatus is communicated directly to the indicator, which makes it extremely accurate. An odometer is driven off the vertical shaft by means of a worm gear.



MOTOMETERS BEING TESTED AT AUTOMOBILE SHOW.

At the recent show the company exhibited three of these meters driven by one small electric motor through three flexible shafts terminating in pinions having 16, 32, and 64 teeth respectively. Consequently, the speeds registered on the different instruments should bear the relation 1 : 2 : 4. The fact that this occurred whether the motor was run at low or high speed, showed that the instruments were accurate at all speeds, no matter whether the speeds were high or low. To make the demonstration more complete, the revolutions of a fourth 16-tooth pinion were taken by a speed indicator, and these revolutions, counted by the investigator, were compared with a table giving the miles per hour that the indicator should show at any given R. P. M. of its gear wheel. So exact was the instrument found to be, that it agreed to the thousandth part, or within one-tenth of one per cent.



TRANSMISSION WITH JAW CLUTCHES.

SOME IMPROVEMENTS IN HONEYCOMB RADIATORS.

Several years ago the honeycomb type of radiator began to appear among certain cars of foreign make. This type of radiator has since become very popular, despite the fact that some prominent manufacturers at home and abroad still favor the use of tubes with radial fins or wings. The honeycomb radiator provides a very large radiating surface, over which the hot water flows in thin sheets. In one make copper tubes of square cross section are used, which are separated by vertical wires at each end, and then soldered together in a block. The water flows through the narrow vertical passages formed between the tubes, and the heat is carried off by the air flowing through the tubes. In another make horizontal as well as vertical wires are used for spacing the tubes, as shown in Fig. 1, so that radiation takes place equally from all sides.

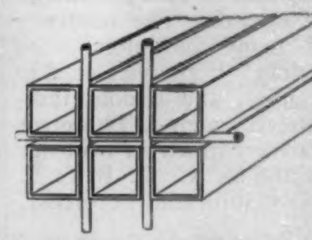


Fig. 1.—RADIATOR TUBES VERTICALLY AND HORIZONTALLY SPACED.

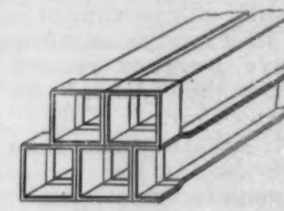


Fig. 2.—RADIATOR FORMED OF EXPANDED TUBES.

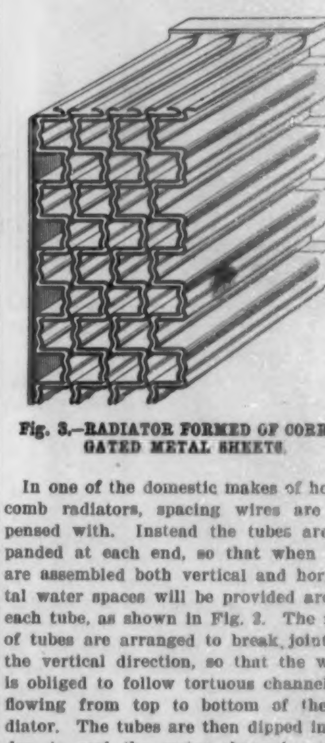


Fig. 3.—RADIATOR FORMED OF CORRUGATED METAL SHEETS.

In one of the domestic makes of honeycomb radiators, spacing wires are dispensed with. Instead the tubes are expanded at each end, so that when they are assembled both vertical and horizontal water spaces will be provided around each tube, as shown in Fig. 2. The rows of tubes are arranged to break joints in the vertical direction, so that the water is obliged to follow tortuous channels in flowing from top to bottom of the radiator. The tubes are then dipped in solder, to seal the water channels at the front and rear of the radiator.

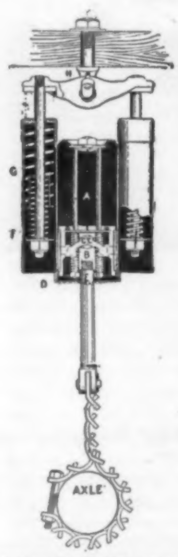
A most ingenious domestic modification of the honeycomb construction is shown in Fig. 3. Square tubes, owing to their expense, are dispensed with entirely. In their place thin sheets of copper are used, these being pressed to form corrugations, the walls of which are rectangular. Alternate corrugations are made somewhat smaller, so that when two sheets are laid together, the smaller corrugations will fit into the larger ones. The corrugations are alternately expanded and contracted at the ends, so that when the sheets are laid together they will be spaced to form continuous but tortuous conduits. The sheets are then fastened together by crimping the cut ends of one sheet over the other. These conduits when assembled form air passages of square section, and when soldered together in a block they are identical in appearance with the European honeycomb radiators, but possess the advantage of a greater radiating surface, because the water is obliged to follow a tortuous course, as indicated in Fig. 3. Furthermore, the construction is far less expensive, owing to the fact that square tubes are not used.

THE MOON TOURING CAR.

The leading model Moon automobile for 1907, is a 30-35 horse-power, 4-cylinder touring car, having shaft drive, 110-inch wheel base, full elliptic springs at the rear, and an aluminium body of the latest French-type. The motor cylinders are cast in pairs integral with their water jackets, and are mounted upon a solid aluminium crank case cast in two pieces. The valves, placed in the cylinder heads, are operated by walking beams from a single cam shaft which runs across the cylinder heads and is driven by a vertical shaft and bevel gears from the crankshaft. This arrangement is one of the simplest that can possibly be devised for the mechanical operation of valves located in the cylinder heads. The engine is provided with a gear-driven centrifugal water pump for circulating the cooling water through its jackets and the honeycomb type radiator. The commutator is located on the dash, and is well incased and protected. Two sets of six-volt storage batteries supply current for the ignition, which is of the high tension type with individual coils. The carbureter is of the latest automatic type and has suitable hot air connections for insuring a perfect mixture under all weather conditions. A mechanical lubricator with sight feeds on the dash is driven by a wire belt from the cam shaft. Splash lubrication in the crank case of the engine is unnecessary, as all the bearings are properly supplied with oil by the lubricator. The clutch is of the multiple disk type, running in oil. It is located in the flywheel and is made up of 57 steel and bronze disks. The transmission is of the 4-speed selective type, provided with babbitted bearings. The transmission is mounted in an aluminium case cast in two halves and having a large sized hand hole in the top. A double universal joint of ample length is provided between the engine and transmission. Should it be necessary to remove either of these parts of the car by first removing this joint, sufficient space is provided to take out either of them without difficulty. The propeller shaft is also fitted with two universal joints. The rear axle is of the usual floating type in which the wheels run upon a tubular axle that incases live driving shafts terminating in a differential and at the outer ends of the wheel hubs. The rear axle is suitably trussed, and the differential case is a steel casting inclosed in a removable aluminium casing. There are universal joints in the live part of the axle on each side of the differential. These make it possible to have an arched rear axle and also to set the wheels in from the vertical 2½ degrees at the bottom, the same as is done with the front wheels. Adjustable ball bearings are used on the wheels. The brakes are of the external and internal type on drums on the rear wheels. The former are worked by the pedal, and the latter by a hand lever which is interlocked with the clutch. An important feature of the pressed steel frame is that there is a drop in it of about 2 inches just forward of the rear axle. This brings the driving mechanism of the car in very good alinement with the axle, and also lowers the center of gravity. A feature of the control consists in the use of a combined throttle and spark advance lever. The throttle lever, which travels over a curved stationary sector in the steering wheel, has on it a button that can be used for advancing or retarding the spark.

THE HOUSE RECOIL CHECK.

A new form of shock-absorber, which has recently been patented by Mr. Henry A. House, is intended to check the rebound of the car body without in any manner affecting the action of the springs under compression. The new device consists of a large cylinder, *A*, in which, mounted upon a suitable head, *B*, of the rod, *E*, are two semicircular brake shoes adapted to be pressed against the walls of the cylinder by means of levers, *C C*. A chain extends down from the end of the rod, *E*, and is attached to the axle of the car. A hanger, *H*, attached to the frame, carries two rods, which extend downward into smaller cylinders on either side of *A* and attached to it. Within each of these cylinders are a pair of coiled springs, *F* and *G*, one of these springs being lighter than the other. With an up-and-down movement of about 4 inches, the rebound is checked by these springs. Should, however, a much greater movement of the frame with respect to the axle occur, the piston, *B*, will travel up-



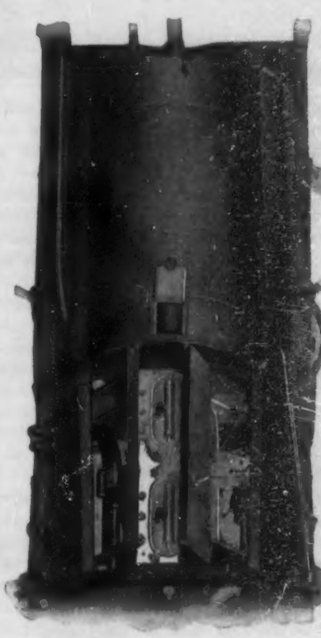
AN IMPROVED SHOCK ABSORBER.

ward in the cylinder, *A*, while the frame is approaching the axle, but will immediately lock, and then travel slowly downward as soon as the rebound begins. The locking of the friction shoes of the piston would cause the body to be drawn downward with the axle when the latter dropped, as the wheel of the car passed over an obstruction; but as there is a play of about 4 inches on the supplementary compound springs, these allow the body to keep on in its upward movement while the piston is slowly descending. The result is that instead of a series of sharp curves being obtained, such as are shown by the record of the instrument described on page 38, the body has a gentle undulatory motion, due to the springs of the car absorbing the downward movement, and the brake shoes and compound springs of the recoil check absorbing the upward movement. This device has recently been perfected, and has given entire satisfaction.

THE 1907 PEERLESS TOURING CAR.

The new Peerless touring car shows the same high quality in material and construction that has always been used by the Peerless firm. The improvements are merely in details, and there is no wide departure from the model produced last year. Some of the parts, such as the springs and the ignition apparatus, are imported from France, in order to insure their being of the very best material. A special feature about the frame is that it is dropped 2½ inches just in front of the rear axle, thus giving the car a lower center of gravity, and increasing the comfort and safety of its occupants at high speed. The steering gear, of the worm-and-sector type, has been greatly strengthened. The sector and shaft are made of a single forging, and the sector is in reality a complete wheel, having three times the wearing surface that was used before. A special form of imported ball thrust bearing is used above and below the worm on the steering column. The front axle is a solid I-beam drop forging having the spring saddles integral. This is the strongest type of axle for a given weight. The axle is curved downward in the center, and the steering knuckles are fitted with imported, self-adjusting ball bearings of large size, oiled by an improved oiling device. Timkin roller bearings are employed on the front wheels. The rear axle is of the usual floating type, the live shafts being of nickel steel in place of the ordinary quality of steel that is usually employed. The bevel driving gears are of large diameter, and are adjustable. The annular ball bearings are fitted with a retaining screen, so that if a ball should break, the broken pieces could not get into the gears. It will be remembered that the Peerless rear-axle construction comprises universal joints in the live axle on either side of the differential, which render possible an arched construction of the axle and dishing of the rear wheels.

The 30 and 45-horse-power Peerless motors, each of the 4-cylinder, vertical, water-cooled type, have a bore and stroke of 5⅝ x 5½ and 5¾ x 5¾ respectively. The crankcase is a one-piece casting of aluminium, having large handholes in the



UNDER SIDE OF PEERLESS CHASSIS.

The pan below the engine is provided with hinged doors so that the crank case can readily be got at from below.

bottom. Each plate that covers these handholes is fitted with a patented arrangement, consisting of a pocket or groove at its lowest point, in which any dirt or sediment from the oil can collect. By removing a plug from this pocket, all sediment and dirty oil can be withdrawn from the crankcase, and the latter can be flushed with kerosene. A steel casing that goes under the motor, and extends from the front of the car to the rear of the transmission, is provided with doors, so that the crankcase can be got at from its under side without removing the pan. This is a decided improvement in the line of accessibility. It is shown in the cut which accompanies this article. The motor is fitted with a gear-driven gear pump and a gear-driven mechanical oiler. The pump shaft is connected with the driving gear through a spring. All the gears are housed and run in oil. The commutator is located on a vertical shaft between the two pairs of cylinders and on a level with the cylinder heads. It is of an improved type, containing but one brush which runs in oil. The ignition system ordinarily fitted consists of separate sets of storage batteries and individual coils. In addition to this a gear-driven Eisemann high-tension magneto is furnished as an extra, if desired. A separate set of spark plugs

placed over the inlet valves is used with the magneto. The clutch is of the internal expanding type, consisting of a leather-lined steel band expanded by a single spring in the flywheel. The transmission is of the four-speed selective type. By meshing the reverse gears on the clash gear system it has been found possible to shorten the gear case and gear shaft several inches, thereby increasing their strength. The shafts are mounted on annular ball bearings lubricated from without, and thoroughly protected from the oil used in the gear box. Both the motor and transmission are mounted upon a three-point suspension, and are connected by a short shaft fitted with two universal joints.

The car is fitted with 34-inch wheels having 4-inch tires on the front and 4½-inch on the rear. The wheel base is 114 inches. Internal and external brakes are used on the rear wheels. The fenders are of the new type, being brought down on the inside to the side bars of the frame, and thus thoroughly protecting the occupants of the car from being splashed by mud or water. Several types of body, both open and closed, are used on the standard chassis.

SOME EARLY AMERICAN AUTOMOBILES.

(*Continued from page 23.*)

lieve the belt and avoid twisting. The drum inclosed a differential gear, and there were driving sprockets on each end of the countershaft. The engine was fitted with make-and-break ignition from dry batteries. The gasoline was allowed to run from a high reservoir to one placed at a lower level. The carbureter, or mixer, was placed between the two, and by an overflow arrangement a constant level was maintained, the excess of gasoline falling into the bottom tank, whence it was raised once more to the upper tank by a small hand pump. Although most of the running of the machine shown in the photograph was done with a friction drive, Mr. Duryea was constantly trying to improve on this, the result being that he fitted a three-speed individual-clutch transmission, which is the arrangement shown in the photograph. The countershaft directly under the flywheel was driven by bevel gears, and carried three separate gears with individual clutches. These gears were constantly in mesh with three other gears on the driving countershaft, which terminated in sprockets, as shown. By picking up the three clutches in succession, he was able to pass from the slow to the fast speed. Vertical movement of the tiller steering lever accomplished this. The machine was in use for several years, and made fairly good speeds (ten or twelve miles an hour), although the inventor at that time did not attempt to go much faster than a horse would trot. The very first Duryea, built in 1891, was constructed along the same lines. Like the machine shown, it was quite a light rig, weighing between 600 and 700 pounds, and it was propelled by a friction drive. It was under-powered, and would only run under extremely favorable circumstances.

The original Haynes gasoline car shown on our front page was built along the lines upon which many of the early designers worked, and which comprised the placing of the engine and transmission upon the running gear and mounting the body on the springs independently. Mr. Haynes built his running gear of steel tubing and mounted it upon wire wheels provided with pneumatic tires which were made specially at a nearby rubber factory. The body was placed upon a pair of side-bar springs. The original engine was of the single-cylinder two-cycle type. It was mounted at the rear of the frame, and drove a countershaft through chains and individual clutches giving two forward speeds. A double chain drive was provided from the countershaft to the rear wheels, as can be seen from the photograph. The machine traveled successfully over the country roads in the vicinity of Kokomo, Ind., at a speed of about 10 miles an hour. Subsequently, Mr. Haynes replaced the two-cycle engine with one of the four-cycle type; but it is nevertheless noteworthy that in striving for simplicity he adopted a two-cycle engine in the beginning, while many people believe to-day that this type of engine will eventually be largely used on automobiles. Another point in which Mr. Haynes was in advance of other American experimenters was the use of pneumatic tires. That he has kept in advance in design and workmanship is evidenced by the novel features of his cars (see page 28) and also by the fact that one of these stock chassis, fitted with a 50-horse-power motor, made an exceptionally fine showing in the Vanderbilt cup race last October. This car, which was exhibited at the automobile show, has been duplicated in touring car form

as the Haynes Company's leading model for the present year.

The machine on our front page which most resembles the automobile of to-day is that constructed more than ten years ago by Mr. Ransom E. Olds, of Lansing, Mich. The picture is reproduced from the SCIENTIFIC AMERICAN of November 21, 1896. Like almost all of the first machines, as above stated, Mr. Olds's early car had the engine and transmission mounted upon the running gear, while the body was supported on three full elliptic springs. The engine used was a single-cylinder one of 5 horse-power placed horizontally on the running gear, and arranged to drive a countershaft through three separate speed changes giving 4, 8, and 12 miles an hour normally, while by speeding up the engine, the car could be driven as high as 18 miles an hour. A single chain from the countershaft drove the rear axle, there being a considerable reduction, as can be seen. The rear axle was provided with a differential. Wood wheels provided with 1½-inch solid cushion tires were used on this car, the wheels being provided with ball bearings. A tiller steering device turned both front wheels on a simple design of steering knuckle. In our former description a great point is made of the fact that the fuel supply is located below the engine, and has no connection with the body. This was done in order to obviate any chance of explosion.

While the machine in question was one of Mr. Olds's first gasoline cars, it was by no means his first machine, as several years before he produced a three-wheeled steam automobile which had a huge boiler behind fired by liquid fuel. After turning his attention to the gasoline engine, however, as can be seen from the illustration, Mr. Olds produced a very creditable machine for that day, and he has since held his own in an industry that has become vast and in which improvements have been made more rapidly, perhaps, than in any other field.

THE CADILLAC 20-HORSE-POWER FOUR-CYLINDER ENGINE AND GOVERNOR.

(*Continued from page 24.*)

around a central vertical or inclined shaft, *A*, driven by gears from the camshaft and running upon ball bearings. Pivoted on a pin passing through this shaft, and held in the tilted position shown by the spiral spring, *C*, is the ring, *B*. As the revolutions of the shaft, *A*, and ring, *B*, increase, centrifugal force tends to make the ring assume the horizontal position shown by the dotted lines, and as it does so, it pushes upward on the link, *D*, and raises the collar, *E*. A shifting fork on this collar, as it is raised and lowered, rotates a shaft, *K*, and consequently moves back and forth the lever, *F*, which is connected by rod, *G*, to the throttle. In this manner the throttle valve is closed. By varying the tension on the spring, *C*, which the driver can do through the connections, *H J*, and their shifting fork, *M*, and collar, *L*, the governor can be set so that it will not close the throttle beyond a desired point. The placing of the commutator above the governor makes it very accessible. This type of governor is an exclusive feature of the Cadillac 4-cylinder cars.

ENGINE OF THE CAR DE LUXE.

(*Continued from page 24.*)

the ordinary force-feed oiler for lubricating the engine, there is a special plunger pump on the footboard, by which oil can be pumped into the crankcase. Should the oil overflow above the proper level, it runs into a special reservoir attached to the bottom of the crankcase. Should the latter overflow, the oil will run upon the ground. The crankpins are all hollow, and they are thoroughly lubricated by means of eccentric oil rings placed upon the crankshaft. The water pump is of the centrifugal type, and is made up of a bronze wheel that revolves in an aluminium casing. The radiator is of horizontal flat tubes indented, so as to allow for expansion in case of freezing. The water circulates back and forth from one side to the other, and from top to bottom through 20, 17, 15, 14, and finally 12 tubes, the idea being that as the water cools in descending from the top to the bottom of the radiator, it does not require so much room. Everything about this motor is of the finest, and it is undoubtedly one of the highest grade automobile engines constructed. The bore and stroke are 125 and 135 millimeters respectively, and the horse-power is 50 to 60. Besides the engine this car contains several other novel features, such as the rear axle, which is described on page 34.

THE AUTOCAR COMBINED ENGINE AND TRANSMISSION.

The engine and transmission shown on p. 24 is that of the type XIV Autocar tonneau, and it is noteworthy as being one of the few examples of the recent practice of combining engine and transmission in a single unit and giving this unit a three-point support. As can be readily seen, the transmission gear case and the crank case of the motor are bolted together, and the two cases are so shaped as to completely inclose the flywheel and clutch. The latter is of the three-ring metallic type, consisting of a bronze ring with cork or felt inserts that is clamped between two steel rings attached to the flywheel. As the bronze ring is rather light, it has but little momentum, and consequently both it and the gears come quickly to rest when the clutch is thrown out. This makes stripping of the gears improbable.

The motor shown is the four-cylinder, vertical, water-cooled one used on the tonneau. (The company also builds for its runabout a 12-horse-power double-opposed cylinder motor having the same arrangement.) The bore is 4¼ inches, stroke 4½, and the motor is said to develop 30 horse-power. The cylinders are cast separately with integral heads, water jackets, and exhaust valve chambers, and large mechanically-operated valves. The inlet valves are placed in the center of the cylinder heads, directly over the pistons, thus insuring complete filling of the cylinders at all speeds. All the valves are large and are mechanically operated from one camshaft, the lifts being provided with large rollers, which insure long life and little friction. The adjustment of the exhaust valve is by cap screws, which screw in the plunger and are held in the desired place by lock nuts. The inlet valve adjustment is by cap and lock nuts on top of the valve lift rod. The crankshaft is a weldless steel forging, oil tempered, with a large flange for bolting on the flywheel. This wheel can be easily removed and replaced with little trouble and no danger of becoming loose or running out of true. The crankshaft has three long split bearings which can be readily taken up should any wear occur. The crank case is made of aluminium alloy, of high tensile strength, and all the bearings are bolted to the upper half. The lower half can be removed without disturbing any other parts, and the crankshaft and pistons can be removed without removing the cylinders. The upper half of the crank case is provided with two large openings, through which all adjustments can be made without removing the bottom half. The camshaft and pump shaft gears are at the forward end of the crank case, where they are fully inclosed and run in oil. The centrifugal water pump is mounted on the crank case, and is directly driven from the camshaft by fiber gears. It circulates the water through a finned tubular radiator.

The timer also is mounted on the crank case and is driven by means of miter gears from the cam shaft. The ignition is of the high-tension type from current supplied by accumulators. Lubrication is effected by a force feed oiler, with an individual pump for each lead pipe. One pipe goes to each motor bearing and a separate pipe to the crank case to keep

up the oil level for the splash lubrication. The oiler is placed on the dash inside of the hood, the sight feeds only being on the rear of the dash and visible from the seat of the car.

The motor, flywheel, clutch, and transmission are contained and enveloped in a special aluminium case of high tensile strength, bolted together and supported as a unit at three points. Two points or legs extend from the motor to the frame and the third point is under the transmission, where it is seated on a stiff spring. This arrangement makes it possible to do away with the heavy sub-frame construction. One of the forward suspension points is seen at *A*, while the third point is shown at *B*.

The transmission is of the sliding gear type with three speeds forward and one reverse, and with direct drive on the high gear. The gears are solid drop forgings of high-carbon steel, oil tempered, with strong, broad faces. The shafts, also, are of high carbon steel and run on extra long Hyatt roller bearings, which insure perfect meshing of the gears, and eliminate any possible wear. A novel feature of the Autocar is the control of the throttle and spark, which is by means of grips forming part of the rim of the steering wheel, and which thus give the operator the use of both hands in case of an emergency. The gear shifting lever and the emergency brake lever are both on the right-hand side of the car. The foot brake consists of separate contracting bands on the hubs of the rear wheels, while the emergency brakes are of the expanding type in these hubs. Application of the emergency brakes first throws out the clutch. An irreversible worm and sector steering gear is fitted.

The rear axle is of the live type, and is of steel, incased in seamless tubing and ground to size. The wheel ends of the axles are squared, and fit the squared openings of the hub, doing away with the use of keys and eliminating any possibility of trouble at this vital point of the drive. Four sets of roller bearings, in connection with large ball thrust bearings, reduce friction to a minimum. The rear axle tube is securely fastened to the frame by two radius rods, which relieve the springs of the drive of the car. No torsion rod is needed. The bevel gears and differential gears are entirely housed and run in oil.

AN AUTOMOBILE MOTOR WITH ROTARY VALVE.

(*Continued from page 25.*)

approximately flat cuts, such as *B*, which form the port spaces 120 deg. apart, there being one for each cylinder. This cutting of the ports in a single shaft insures absolute timing of the valve action, while the single cut serves both for the exhaust and the inlet ports. The three cylinders are cast in one piece with a single port, *P*, at one side of each cylinder. The three ports are surrounded by water, which insures perfect cooling; besides this they are of short length and small surface, which makes for greatest efficiency. The diagrams make plain the arrangement of the ports, as well as the various positions of the valve for admission, ignition, and exhaust. The large diagram shows plainly the practically straight passage of the gas into the engine, the short cylinder port with consequent small area, and the sweep of the incoming cool charge against the hot cylinder head and spark plug, which makes it certain that the mixture at the point of ignition will be little, if any, diluted by the residue of the preceding charge.

In the second diagram, showing ignition position, the cylinder port is closed. Its wall area and contents are both very small, while the surfaces of the valve and valve bushing in contact are very large, thus insuring freedom from leakage. Furthermore, the position of the motor, which is inclined at an angle of 30 deg., as in all Duryea vehicles, is such that the piston movement throws any oil that may be above the piston head into this port, thus perfectly and copiously lubricating the valve, particularly at the compression dead center, where the pressure is highest and the need for a tight joint most imperative. The sketches do not show an ignition method, but both the jump spark and the make-and-break have been fitted to this style of engine with equal satisfaction, although Mr. Duryea prefers the larger spark secured by the make-and-break system.

The third diagram shows the valve in the exhaust position, and makes quite plain the straight passage for the escape of the heated charge. These ports are 3 inches long by about ¾ inch wide. They open more suddenly than most poppet valves. Their large size, quick action, and perfect shape contribute to superior results. It is readily seen that with a poppet valve the gases conflict with each other, coming, as they do, from opposite sides of the valve toward a common center, and that they are further retarded by this center being occupied by the valve stem and valve stem guide used in the ordinary construction. Further, the ordinary poppet valve can neither be cooled nor water-jacketed, and frequently gets red hot. It is always much hotter than is compatible with proper wearing, so exhaust valves, as is well known, give users considerable trouble. They frequently need regrinding as well as renewing, while the wear of the tappets and cams, breaking and loss of temper of the springs, wearing of the guides, pitting of the valve surfaces and valve seat surfaces, and similar destructive effects, all contribute to make the ordinary exhaust valve a thing to be avoided if possible. With this type of valve, too, there is no chance of a valve breaking and slipping into the cylinder, with the result that the cylinder is cracked and has to be replaced—a matter of considerable expense if the cylinders are cast in pairs. In fact, these troubles have made engine users look toward the two-cycle engine as a possible better device. The Duryea rotary valve avoids these troubles. There are no springs, cams, or tappets. The motion is a smooth rotary motion, perfectly balanced, instead of a clatter and multiplicity of varied strains. There are no springs, slides, cams, or gears. The valve is ground accurately to size, although the packing surfaces are so large and the lubrication so perfect that a slight variation in size produces no perceptible loss. Both the valve and the lubricating oil on its surface are kept cool by water all around the cylinder ports, as well as water through the center of the valve. This double water cooling absolutely prevents overheating of any part or burning off of the lubricating oil, and so perfectly insures long life to both the valve and its bushing. The valve bushings are removable, so that in case of damage, such as might occur by some foreign substance passing through the valve and scoring the surface, both valve and bushing can be removed without detriment to the cylinder casting. The expense of upkeep is extremely slight, for the bushings are not of great cost and the valve, after a long period of use, can be reground if necessary, and a slightly smaller bushing fitted at little expense.

The valve is driven by a silent, self-adjusting chain, which is long-lived and needs no attention. This chain is free from the noises that accompany gears, particularly after they have been in use long enough to wear slightly, for gears under the intermittent action of the valves become quite noisy as soon as they get slightly loose. The spark timer is attached to the valve shaft on the outer side of the sprocket, while the water enters and leaves the valve at the opposite end.

In general this design of engine is the most simple yet seen for a four-cycle, and avoids the objectionable features of the two-cycle, such as leaks around the sides of the piston from the transfer port to the exhaust port, the loss of crankcase compression because of the wearing of the piston and cylinder, and the mixture of the lubricating oil with the explosive

charge. A slight comparison of the duties of this valve with the crankshaft of the same engine is interesting. The area of the 5-inch piston is approximately 20 square inches, while the area of the exposed surface of the valve is but a little over one-tenth this amount, being less than 2¼ inches. The bearing surface of the valve shaft extends the full width of the cylinder, whereas the bearing surface of the crankshaft does not total one-half of this amount, because of the crank-sides and crankpins which must be provided for. From this it will be seen that the work done by the valve is but 1/20 the work done by the crankshaft, and yet to provide ample packing surface, the valve diameter and consequent surface is 30 per cent greater than the crankshaft diameter. From this comparison, as well as from the results given in practice, it is readily seen that the life of the valve should be very long under normal usage.

Experiments have been made with tapered valves fitting their bushings as does an ordinary stopcock, but trial of both kinds has convinced Mr. Duryea that even the slight added cost and complexity of the tapered form is not necessary to secure the desired results.

In service, the rotary valve engine runs almost like a steam engine. The mechanical operation of the inlet permits perfect admission of the attenuated charge admitted at low throttle, and secures a wide range of speed because of this smooth running at low speeds, as well as because of the lack of reciprocating parts, which clatter and pound badly at high speeds. The crankshaft bearings are made quite large, and the connecting rods are forged and of so strong a design that high speeds cannot damage them.

The prediction is freely made that this invention is one of the most marked improvements in the four-cycle gasoline automobile motor that have been made in recent years. Mr. Duryea has several patents pending upon this device.

THE 50-HORSE-POWER NORTHERN ENGINE.

(*Continued from page 25.*)

arate steel pan. Nipples screwed into the cylinders just above the highest point of piston travel carry horizontal pipes with three vertical outlets, the center one of which carries a spark plug, the right-hand one a priming cock, and the other a patent relief valve for each cylinder. The relief valves are all connected together so that the chauffeur can, by pulling a handle, put them all in operation when turning over the engine. These valves only open when the compression occurs, and as soon as an explosion takes place, they instantly close.

The motor is started by a long lever having a pawl that engages the teeth of a ratchet wheel on the crankshaft. The movement of the lever in starting the engine automatically retards the spark. The two-to-one gears are shown incased at *T*, and are used as a water pump to force the cooled water received from the bottom of the radiator through the large pipe, *W*, leading to the bottom of the water jackets. The bracket for the fan belt pulley, seen at the front end of the engine, is mounted on a vertical spindle that can be raised or lowered by turning the star wheel on top. Thus the fan belt can be easily and quickly tightened. The cylinders of the Northern engine are slightly offset, which gives a more direct thrust on the working stroke.

A SUCCESSFUL FRICTION-DRIVE AUTOMOBILE.

(*Continued from page 26.*)

tenber engine rated at 40 H. P. at 1,000 R. P. M. The timer is shown at *T*. *P* is one of the connections between the timer and the base of the steering column, *V*, for advancing the spark by means of one of the levers that travel over the stationary segment in the steering wheel. The motor is provided with an 8-feed mechanical oiler, which efficiently lubricates it.

A NOVEL INDIVIDUAL CLUTCH TRANSMISSION.

(*Continued from page 29.*)

the end of the sliding shaft, *C*, the ends of which press the internal expanding wedge, *M*, forward, thus causing the four wedge pins, *K*, to protrude beyond the periphery of the shaft, *C*, opening the frictions, *P*, against the internal wall of the bronze ring gear, *A*. This action makes the whole mechanism integral. To change the speed the sliding shaft is simply located under any gear desired and the operation repeated. *D* is the differential from which the jack shaft, *J*, protrudes from either side, to the sprockets. The reverse is accomplished by an intermediate gear which is located in a pocket at the bottom of the case under another gear (which is shown as not in mesh and on the shaft, *E*.)

THE GROUT 35-HORSE-POWER CHASSIS.

(*Continued from page 31.*)

tion is by accumulators and a single spark coil. The high-tension distributor is combined with the commutator, *C*, which is operated by a lever in the steering wheel. The muffler appears at *M*. The engine and transmission are mounted on an angle steel sub-frame, as shown.

Levers *A* and *B* operate the three-speed progressive sliding-gear transmission and the expanding emergency brakes on the rear wheels. The former lever is connected through the horizontal lever, *D*, with the sliding rod, *R*, that extends into the gear case, and shifts the gears, while the latter lever, *B*, when drawn toward the driver, applies expanding brakes in the rear wheels. The pedal, *E*, operates the contracting brakes on the rear wheel hubs, while the pedal, *F*, controls the clutch, which is of the ordinary leather-faced cone type. There is a large universal joint, *U*, between the clutch and the gear box, and the countershaft is provided with Oldham universal couplings between the gear box and the frame. One of the driving sprockets on the countershaft is seen at *J*. A cylindrical gasoline tank of 15 gallons capacity is placed under the front seat, and the pipe, *P*, extending from its lowest point to the carbureter, feeds the latter by gravity.

THE NORTHERN FOUR-CYLINDER 50-HORSE-POWER CAR.

(*Continued from page 34.*)

son, the Northern Motor Car Company has placed on the market a 50-horse-power car embodying all the essential features of the air control. Clutch and air control features remain practically the same as last year, with the exception that the parts are increased in proportion to the larger car, which is rated at 50 horse-power.

It will be noticed that the entire control is placed on the steering column, and that all side levers are omitted. The gear-shift lever is placed horizontally just below the steering wheel, and the small lever which operates the shift gears controls the clutch. A slight turning motion of the hand grip on this lever throws in or releases the clutch. It will be seen that practically the same motion that shifts the gears operates the clutch at the same time. The reverse operation is taken care of with the right foot by pressing on a pedal projecting from the steering column. This reverse position is interlocked in such a way that the reverse can only be operated in a certain position of the gears. The transmission is placed on the rear axle. It is very compact, and runs on roller bearings of the Timken type. Easy adjustment and accessibility are marked features of this arrangement. Ball bearings are provided for the steering spindles as well as the worm and segment mechanism, which renders steering very easy.

Special attention is directed to the pivotal rear platform spring, which permits of either of the rear wheels passing over an obstruction without imparting any shock to the car frame. It will be

(*Continued on page 56.*)

The New Agriculture

By T. BYARD COLLINS

12mo, 374 pages, 106 illustrations. Cloth, price, $2.00

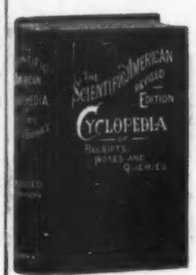
This new and valuable work sets forth the changes which have taken place in American agricultural methods which are transforming farm life, formerly so hard, into the most independent, peaceful, and agreeable existence. Farm life to-day offers more inducements than at any previous period in the world's history, and it is calling millions from the desk. The present work is one of the most practical treatises on the subject which has ever been issued.

The latest and best book on the subject. Contents: I. The New Call to the Farm.—II. The New Soil—Irrigation.—III. The New Fertilization.—IV. The New Transportation.—V. New Interests.—VI. New Creations.—VII. New Varieties.—VIII. New Practice.—IX.—New Machinery.—X. The New Inspiration.

The Scientific American Cyclopedia of Receipts Notes and Queries

15,000 RECEIPTS
734 PAGES

Price, $5.00 in cloth; 6.00 in sheep; $6.50 in half-morocco, postpaid



THIS splendid work contains a careful compilation of the most useful Receipts and Replies given in the Notes and Queries of correspondents as published in the SCIENTIFIC AMERICAN during the past fifty years; together with many valuable and important additions.

OVER FIFTEEN THOUSAND selected receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public.

Scientific American Reference Book

12mo, 516 Pages, Illustrated, 6 Colored Plates

Price, $1.50 Postpaid

The result of the queries of three generations of readers and correspondents is crystallized in this book which is indispensable to every family and business man. It should be found on every desk. It is extensively used by government officials. It has been revised by experts. The book contains 50,000 facts and is much more complete and exhaustive than has ever been attempted. It is profusely illustrated with engravings, many of them imparting the information by means of comparative diagrams. It is like no other book. It tells how to harness a horse and read a gas meter as well as giving hundreds of statistical tables. The very wide range of topics treated may be judged by the table of contents which is mailed free on request. Remit $1.50 and the book will be promptly mailed.

Experimental Science

By GEORGE M. HOPKINS

Revised and Greatly Enlarged. 2 Octavo Volumes. 1100 Pages. 900 Illustrations
Cloth Bound, Postpaid, $5.00

A New, Revised, and Enlarged Edition has been issued

OWING to the amount of new matter added, the book is now published in two volumes, handsomely bound in buckram. Of the additions which have been made, among the most important are: A full illustrated description of 1/4 H. P. Electric Motor, prepared expressly for this edition of EXPERIMENTAL SCIENCE; chapters on Alternating-Current Machinery, and clear, concise Explanations of Wireless Telegraphy and Telephony, Electrical Measuring Instruments, the Electric Clock, the Telegraphone, High Tension Currents, the Nernst Lamp, and methods of measuring the heat of the stars. No other work contains such a fund of trustworthy, up-to-date scientific information, presented in a clear and simple style. Send for descriptive circular.

Home Mechanics for Amateurs

By GEORGE M. HOPKINS
Author of "Experimental Science"

12mo, 370 Pages, 320 Illustrations. Price, $1.50 Postpaid

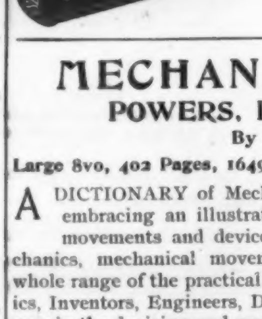
The book deals with wood-working, household ornaments, metal-working, lathe work, metal spinning, silver working; making model engines, boilers and water motors; making telescopes, microscopes and meteorological instruments, electrical chimes, cabinets, bells, night lights, dynamos and motors, electric light, and an electrical furnace. It is a thoroughly practical book by the most noted amateur experimenter in America.

Every reader of "Experimental Science" should possess a copy of this most helpful book. It appeals to the boy as well as the more mature amateur. Holidays and evenings can be profitably occupied by making useful articles for the home or in building small engines or motors or scientific instruments.

ELECTRICIAN'S HANDY BOOK

By Prof. T. O'CONOR SLOANE, A. M., E. M., Ph. D.

Handsomely Bound in Red Leather, with Titles and Edges in Gold. Pocket Book Style. Price, $3.50



A THOROUGHLY practical reference book of 768 pages, covering the entire field of electricity. Contains no useless theory. Everything in it is to the point and can be easily understood by the student, the practical worker, and the everyday working electrician. The advanced electrical engineer will also receive great benefit from its perusal and study.

It is a work of the most modern practice, written in a clear, comprehensive manner, and covers the subject thoroughly, beginning at the A B C of the subject, and gradually takes you to the more advanced branches of the science. It teaches you just what you should know about electricity.

INDUSTRIAL ALCOHOL

ITS MANUFACTURE AND USES

450 Pages; 105 Engravings Price, $3.00

This is a practical treatise based on Dr. Max Maercker's introduction to distillation, as revised by Drs. Delbrück and Lange, by John K. Brachvogel, M.E. It comprises raw materials, malting, mashing, the preparation of the yeast fermentation, distillation, rectification and purification of alcohol, the value and significance of tax-free alcohol, the methods of denaturing and the utilization of denatured alcohol for light, heat and power production. This is the latest and most authoritative book on the subject and is based on researches of eminent German specialists.

MECHANICAL MOVEMENTS

POWERS, DEVICES, AND APPLIANCES

By GARDNER D. HISCOX, M.E.

Large 8vo, 402 Pages, 1649 Illustrations, with Descriptive Text. PRICE, $3.00

A DICTIONARY of Mechanical Movements, Powers, Devices, and Appliances, embracing an illustrated description of the greatest variety of mechanical movements and devices in any language. A new work on illustrated mechanics, mechanical movements, devices, and appliances, covering nearly the whole range of the practical and inventive field, for the use of Machinists, Mechanics, Inventors, Engineers, Draughtsmen, Students, and all others interested in any way in the devising and operation of mechanical works of any kind.

MECHANICAL APPLIANCES

MECHANICAL MOVEMENTS AND NOVELTIES OF CONSTRUCTION

AN Encyclopedia of Mechanical Movements and Mechanical Appliances, including many Novelties of Construction used in the practical operation of the Arts, Manufactures, and in Engineering. For Engineers, Draughtsmen, Inventors, Patent Attorneys, and all others interested in Mechanical Operations.

By GARDNER D. HISCOX, M.E.

Being a Supplementary Volume to the Author's Work entitled Mechanical Movements, Powers, and Devices. Contains 1000 Special Made Engravings. 400 Pages. Cloth Bound. PRICE, $3.00

The above two volumes sold together for $5.00 Postpaid

MUNN & COMPANY, Publishers, 361 Broadway, New York

DYNAMO AND MOTOR COMBINED.—Fully described and illustrated in Scientific American Supplements 844 and 865. The machines can be run either as dynamos or motors. Price 10 cents each, by mail. Munn & Company, 361 Broadway, New York City, and all newsdealers.

WIRELESS TELEGRAPHY.—ITS PROgress and Present Condition are well discussed in Scientific American Supplements 1425, 1426, 1427, 1386, 1388, 1389, 1383, 1381, 1347, 1328, 1329, 1431. Price 10 cents each, by mail. Munn & Co., 361 Broadway, New York City, and all newsdealers.

New Catalogue of Scientific and Technical Books

A new 112-page Catalogue is now ready for distribution. It is entirely new and lists 5,000 of the latest and best books of a scientific and technical nature. Copies are being mailed to all subscribers to our periodicals, but those who purchase our publications at news stands, or read them in libraries, should send at once for a copy of our Catalogue, which will be mailed free to any address in the world.

MUNN & COMPANY, Publishers, 361 Broadway, New York City

noticed that if one of the rear springs rises over an obstruction, the rear platform spring serves as an equalizing lever, depressing the spring on the opposite side an equal amount. The center, or pivotal point, on the platform spring is not raised, as it remains neutral, and thus no shock is imparted to the body or passengers. With this construction it is claimed that the passengers in the rear seats ride as comfortably as those in the front seats of the car. The rear side springs are 60 inches in length, and serve a twofold purpose as springs and strut rods. These springs, owing to their length, render a support to the frame at points which are well forward and under the load which the car is designed to carry. The wheel base is short considering the high power of the engine, and the turning radius is extremely short, thus making the car very easy to drive through crowded traffic and narrow streets.

The gas lamps are placed on top of the front fenders for the following reasons, which have been worked out and demonstrated in practice: (1) The lamps

FRONT OF ROYAL TRANSMISSION, SHOWING PINION AND SECTOR FOR SHIFTING GEARS.

REAR OF ROYAL TRANSMISSION, SHOWING BRAKE, SAFETY RATCHET RING, AND UNIVERSAL JOINT OF PROPELLER SHAFT.

are removed from the point where they are in danger of being smashed in traffic and in collision. (2) The focal plane is materially raised, thus throwing a better diffused light and eliminating long shadows on a rough road, which would be made most apparent with lamps in a lower position. (3) The direct line of travel of the wheels is lighted. (4) The lamps being placed at the outside edge of the car, at once establish to the other driver the clearance that is necessary in passing. (5) The lamps are thus removed from being in close proximity to the starting arrangement, which gives ample room to take care of the initial start of the car.

SOME INTERESTING MECHANICAL LUBRICATORS.

(*Continued from page 36.*)

ing in the cover of the lubricator. In this shank is the stud which bears against the cam, and it may be adjusted by means of thumb nuts to vary the stroke of the piston. The pistons are formed with slots at each side which are not directly opposed. While the piston is being drawn upward, it is rotated to bring one of the slots into engagement with the suction port. This draws oil into the bottom of the cylinder. On the downward stroke, the piston is rotated to bring the opposite slot into registry with the delivery port, so that the oil in the cylinder is then forced out to the points of application.

AN INSTRUMENT FOR TESTING SHOCK ABSORBERS.

(*Continued from page 38.*)

it may be stated that the second line, No. 10 of Fig. 2 corresponds very nearly with the second line No. 9 of Fig. 1. For the portion of the diagram between *a* and *b* the average motion of the car body toward the axle for the diagram of Fig. 2 is 1.12 inches, against the average of the similar motion for diagram Fig. 1 of 0.94 inches. In other words, the average motion toward the axle has been reduced 16.1 per cent. The average motion away from the axle for the same portion of the diagram in Fig. 2 is 1.02 inch, against an average of 0.71 inch in Fig. 1, giving a reduction in the average motion away from the axle of 30.4 per cent.

The total average motion of the car body relative to the axle without eliminators for this portion of the diagram (Fig. 2) is 1.12 + 1.02, or 2.14 inches; while the total average of the same motion when the shock eliminators were applied is 0.94 + 0.71, or 1.65 inches, which gives a reduction of the average motion of the car body while passing over this crosswalk of 22.9 per cent.

The maximum motion of the body toward the axle *Z* in the diagram Fig. 2 is 2.58 inches, against the similar motion *Z* in the diagram Fig. 1 of 2.22 inches, or the maximum downward movement of the body was reduced 0.36 inch, or 14.0 per cent. The maximum motion toward the axle *Y* in Fig. 2 is 2.40 inches, against 1.52 inch in Fig. 1 or the upward motion of the body was reduced 0.88 inch, or 36.7 per cent. The maximum vibration, then, without the eliminators, Fig. 2, was 2.58 + 2.40, or 4.98 inches, against 2.22 + 1.52, or 3.74 inches, in Fig. 1, with the eliminators applied, which gives a reduction in the maximum vibration of the body by the use of the eliminators of 1.24 inches, or 24.9 per cent.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 1, 1907.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acetylene generator, A. G. Odell 840,361
Adjustable bracket, G. Cutter 840,046
Advertising apparatus, K. J. H. Klempau. 840,134
Aerial cables, apparatus for erecting, R. S. Peirce 840,009
Aerial ropeways, clutch for, G. Ceretti 840,100
Agricultural implements, spindle or hub for, W. C. Barker 840,288
Air brake, L. E. Black 840,197
Air brake, automatic, A. Parker-Smith 839,881
Air brake safety appliance, W. H. Winks .. 840,279
Airship, J. Meden 840,078
Airship, H. H. Johnson 840,339
Alarm in case of burglary, etc., apparatus for automatically giving, J. Carter 840,432
Amusement device, F. T. Hoover 840,214
Amusement device, J. E. Cisco 840,299
Angle-iron and the like into different shapes of curvature, machine for bending, E. O. Huvig 840,217
Animal trap, J. Gass 840,206
Apartment house with disappearing bed, L. Holmes 839,996
Arch and analogous structure, D. B. Luten .. 840,224
Automatic lubricator, M. Klemm 840,345
Automatic signal, J. Shoecraft 840,095
Automobiles, radiator for, F. A. Bryant 840,295
Axle box, J. S. Taylor 840,390
Axle box lid, car, A. C. McCord 839,871
Axle box lid, car, W. G. Dunham 839,922
Bag, K. Oswald, Jr. 840,086
Bag fastener, safety, F. F. Jacob 840,218
Bag holder, J. W. Gregory 840,316
Bait, trolling artificial, W. D. Chapman 839,917
Ballot and distributer box, secret, G. L. Murden 840,151
Banding machine, A. Shedlock 840,022
Bank, portable savings, W. E. Sexton 840,262
Barrel follower, C. Kuheim 839,859
Barrel hoop, C. Hoff 840,212
Bathing hood, R. Stollberg 840,169
Batteries or electrolytic apparatus, manufacture of elements for, F. A. Decker .. 839,815
Battery elements, coupling for, F. A. Decker 839,817
Bearing, roller, L. P. Walter 839,973
Bearing, thrust, T. S. Patterson 839,885
Bearings, adjusting device for cone ball, F. T. Farmer 840,306
Bed, couch, Frank & Taylor 840,450
Bell, P. C. Arnold 840,417
Belt fastener, Reed & Duecker 839,955
Belt shifting apparatus, N. H. Anderson ... 839,915
Belt stretcher, W. Baker 840,191
Bicycle support, E. G. May 840,357
Blind and fixings for same, multiple roller-, H. Graff 840,313
Blind apparatus, spring roller, W. McLaren 839,948
Boats, knockdown sailing attachment for row-, C. L. Burgoyne 840,198
Boiler, M. Davis 840,114
Boiler tube cleaner, C. S. Knight 840,221
Bolt extractor, W. McCormick 840,233
Bosh plate, W. D. Berry 840,195
Bottle cleansing, process of and apparatus for, E. Wagner 840,273
Bottle closure, J. W. Zimmerman 839,977
Bottle corking machine, F. Alexander 840,109
Bottle, non-refillable, E. Weber 840,403
Bottle, non-refillable, Gehman & Giannone .. 840,453
Bottle rinsing, spraying, and brushing mechanism, C. H. Loew 839,864
Bottle, safety, Wiegand & Braunersreuther. 840,031
Bottle tap, W. H. Hommel 839,930
Box, J. H. Williamson 840,277
Boxes, press for pressing lids on, A. McHenry 840,236
Braiding machine, E. Anchel 840,414
Brake and brake-rod operating device, G. W. Barlow 840,193

Brake system, C. W. Larson 840,136
Brewing purposes, cooker for, C. Rach 840,370
Brick, manufacturing, A. A. Gery 839,833
Brick mold, H. Routt 839,962
Bricks, etc., manufacturing, A. A. Gery 839,832
Broom holder, F. P. Gee 840,452
Brush, J. F. Bowditch 840,106
Brush, E. Melchior 840,227
Brush back, C. E. Conder 840,435
Brush, horse, J. S. Hickson 840,328
Buckets and other receptacles, combined rest and handle for, P. H. Weideman 840,098
Buckle, M. E. Hutchison 840,063
Buckle, M. Barabasz 840,192
Buildings, metallic structural element for, H. L. Dunn 840,053
Buncher, side delivery, N. G. Hanna 840,320
Burial casket, J. Maxwell 840,077
Burner, J. H. Ackroyd 840,412
Bushing and making same, J. R. Simpson 840,165
Butter-pat machine, Linsiewicz & Klein 840,145
Cabinet, cooling and dispensing, T. Thuemling 840,176
Cabinet, kitchen, A. Franke 839,992
Cable clamp, F. B. Cook 839,919
Cameras, stereoscopic attachment for photographic, W. Salow 840,378
Cane, repeating torpedo, J. H. Bevington 840,425
Car brake, D. J. Houghton 840,215
Car coupling, J. Gaszper 840,126
Car door, grain, Holmes & Boatright 839,848
Car, dumping, A. C. McCord 839,870
Car fender, E. W. Wheelock 840,180
Car frame, railway, W. F. Kiesel, Jr. 839,857
Car stop, automatic, J. S. Pates 840,247
Cars, needle-beam for railway, H. M. Pflager 839,952
Carbon, arc light, A. Kufferath 840,222
Carbureter, G. E. Franquist 840,204
Card clothing, apparatus for hardening the teeth of, L. C. Schneider 840,090
Card support, H. J. Phillips 840,459
Carpenter's tool, B. Stoll 840,268
Casting apparatus, McKee & Schilling 840,153
Casting machine, ingot, N. H. O. Lilienberg 839,861
Cellulose products, manufacturing, Eck & Bechtel 839,825
Cement composition, magnesia, W. L. Dudley 839,820
Chain, drive, J. T. Nicholson 840,240
Chair attachment, W. C. Martin 839,944
Chair fan attachment, rocking, S. J. Taylor 839,904
Check for safe keeping of articles, F. C. Stevenson 840,168
Cheese cutter, W. A. Loshbough 840,352
Chemical apparatus, H. B. Snell 840,391
Chip breaker, L. J. Nelson 840,238
Chocolate press, continuous screw, G. Carlson 840,298
Churn, J. L. Merideth 839,866
Churn, E. L. Allen 840,035
Churn and butter-worker, combined, G. J. Kaplan 840,133
Cigar and cigarette holder, F. J. Seyfried 840,385
Cigar pressing box, R. Woerner 840,183
Cigarette mouthpieces, machine for applying, F. X. Malocsay 840,004
Cigarette packing machine, A. Abbott 840,187
Clay mill, T. R. Brittain 840,107
Cleaning and grading apparatus, J. Gaynor 839,925
Clevis, interlocking, E. J. J. Gregerson 840,128
Clothes-drying frame, G. S. Stebbins 840,267
Clutch, W. J. Hilliard 839,844
Clutch or brake mechanism, Laidlaw & Macfarlane 840,223
Coal at sea, device for taking in, H. O. Adam 840,099
Coal tipple, J. S. Pates 840,248
Cocks, device for operating train pipe, N. F. Niederlander 839,878
Collar, horse, R. E. Cady 839,809
Commutator, M. E. Fuld 840,451
Concrete and the like, machine for mixing, W. J. Judd 840,067
Concrete block machine, F. W. Cooley 839,812
Concrete block mold, J. P. Heckman 839,842
Concrete building-block making machine, J. Miller, et al 840,006
Concrete work, binding sheet for, J. H. Schlafly 840,016
Conduit, L. A. Jones 840,066
Conveyers and for feeding machinery, propelling endless aprons for, P. H. Ertheiler 840,446
Corn hulling machine, green, W. Caldwell 840,296
Corsets, truss attachment for, I. Baer 840,285
Cotton chopper, S. A. Cowart 840,439
Cotton picker, J. K. Piper 840,367
Cradle, W. Adler 840,284
Crate, collapsible, H. H. Ide 839,852
Cultivator, A. T. Westlake 840,404
Cultivator hopple, S. A. Cowart 840,438
Cultivators, spring trip for, Reeves & Gilchrist 839,956
Curtain pole, B. Adamowicz 840,282
Curtain rod-supporting bracket, T. C. Richards 839,959
Curtain stretcher, F. S. Stanfield 839,969
Cycle driving gear, W. Boos 839,979
Dam, W. L. Church 840,042
Dam, H. L. Coburn 840,110
Die plate, J. J. Malloy 840,147
Dish-washing apparatus, R. R. Smith 839,898
Display dish rack, J. B. Timberlake 839,906
Display rack, Copp & Frank 840,112
Door-holder fixture, J. S. Naery 839,876
Doors, display frames, etc., movable supporting means for, J. Hofman 840,061
Dough dividing machine, H. F. W. Hueg 840,062
Dredge, G. W. King 839,934
Dressing table and clothes press, combined, H. Knapp 840,347
Drill. See Grain drill.
Drill, G. E. Eaton 839,824
Drill bit for wells, C. W. Guttzeit 839,837
Drill shaping machine, J. H. Green 839,835
Drinking fount for live stock, H. M. Smith 839,964
Drying apparatus, J. E. Barney 840,037
Dump and elevator, J. F. Collins 840,300
Dyeing textile fiber violet blue, O. Bally 840,419
Eaves trough-forming machine, J. H. Schlafly 840,382
Electric furnace, W. H. Bristol 839,983
Electric light globes, means for cleaning or manipulating, C. D. Bates 840,102
Electric power distributing systems, controlling, J. L. Routin 840,013
Electric switch, Hewlett & Button 840,327
Electrical distribution, panel board for, E. N. Lake 840,068
Electrical distribution system, R. Hundhausen 840,216
Electrical plug receptable, F. J. Russell 840,014
Electrochemical apparatus, F. A. Decker 839,816
Electromagnetic signal, H. M. Crane 840,201
Elevator, B. H. Alvey 840,189
Elevator gate-closing means, C. W. Kirsch 840,344
Embossing presses, wiping attachment for power, L. M. Winter 840,280
Embroidering machine, A. Nufer 840,243
Embroidery machines, fabric holding rack for, C. Eugster 839,923
Engine driving mechanism, traction, M. Wilson 839,914
Engine tender, traction, G. L. Schmidt 840,017
Envelop opener, A. D. Ross 839,960
Eraser, ink, W. H. Jones 840,131
Excavating machine, S. Olson 839,949
Eyeglass guard, E. J. George 839,831
Fan, draft-producing, L. Myers 840,230
Fan motor, spring operated, L. Myers 840,231
Fastening means, N. B. Stone 840,395
Feed box, metallic, H. M. Thayer 839,905
Feed water heater, H. G. Miller 839,867
Feed water heater, J. E. Proctor 840,252
Feed water heater for locomotives, R. Burns 840,108
Feeding mechanism, A. Shedlock 840,023
Feeding mechanism, G. W. Donning 840,203
Feeding trough, H. W. Lineweaver 840,003
Fence construction, wire, E. W. Cornell 840,113
Fence post, L. D. Ewing 840,124
Fence post base, H. L. Fell 839,829
Fence posts and railway ties, manufacturing of, H. M. Shellabarger 840,263
Fencing tie, wire, W. H. Shierson 840,164
Fertilizer distributer and plow, combined, J. B. Corsbie 840,437
Filter for cisterns, platform, R. E. Tipton 840,400
Filter, oil, T. T. Sawdon 840,381
Filter scraping machine, closed, H. W. Blaisdell 840,104
Fire alarm and watch service system, J. McFell 839,873
Fire escape, R. D. Warfield 839,974

The Paris Automobile Show

The current issue of the Scientific American Supplement No. 1619 contains a full illustrated description of the novelties exhibited at the Paris Automobile Show. The article is written by our special correspondent. For European improvements, read the Supplement. Price 10 cents by mail. Order from your newsdealer, or from

Munn & Company
361 Broadway - - - - New York

SUBSTITUTES FOR COAL
Are described from the technical standpoint in the following Scientific American Supplements.

Each Supplement named costs 10 cents by mail:

COMMERCIAL USES OF PEAT. SCIENTIFIC AMERICAN SUPPLEMENT **1324.** The article enumerates the principal peat bogs and states their financial possibilities.

GERMAN BRIQUETTING MACHINERY IN AMERICA. SCIENTIFIC AMERICAN SUPPLEMENT **1411.** A valuable economic report.

A NEW ELECTRICAL PROCESS FOR THE MANUFACTURE OF PEAT FUEL. SCIENTIFIC AMERICAN SUPPLEMENT **1492.** The paper fully describes the Bessey process.

LIGNITE, PEAT, AND COAL DUST FUEL. SCIENTIFIC AMERICAN SUPPLEMENT **1426.** A careful consideration of German methods.

DOMESTIC COKE AND BRIQUETTES FROM RETORT COKE OVENS. By R. M. Atwater, SCIENTIFIC AMERICAN SUPPLEMENT **1211.** A valuable monograph by an expert.

THE WHITE MINERAL PRESS FOR BRIQUETTING. SCIENTIFIC AMERICAN SUPPLEMENT **1224.** An article describing and illustrating an American briquetting machine.

Price 10 cents each, by mail.
Order through your Newsdealer or from
MUNN & COMPANY
361 Broadway NEW YORK

Fire extinguishers, alarm for automatic, W. A. Goldthwait 840,311
Fire extinguishers, alarm for automatic, F. H. Rice 840,375
Firearm, P. Lister 839,938
Firearm, P. Mulock 840,085
Fireproof building construction, C. Collins.. 840,111
Fireproof structure, J. D. Ripson........ 840,011
Fireworks, L. Nordlinger 840,242
Flasks, packing, H. W. Lengfelder........ 840,070
Floor scraper, F. F. Hase........ 839,994
Flue stop, J. H. Kinley........ 840,343
Fluid joint, flexible, C. G. Hawley..840,324, 840,325
Fluid pressure brake, A. Parker-Smith, 839,882 to 839,884
Fluid pressure brake, W. H. Sauvage........ 839,893
Fluid pressure engine, R. H. Stollar........ 840,394
Fluids, apparatus for the mechanical clarification of, W. Rottmann 839,892
Fly trap, J. O. Windust........ 840,278
Folding machine, W Spaickhaver 839,899
Food substances, dehydrating, E. W. Cooke. 840,436
Frames and tubes, manufacture of, E. C. F. Verschave 840,271
Frosting or icing pan, W. F. Morris........ 840,083
Fuse, detonating, H. Maxim 840,226
Garment hanger, T. F. O'Connell........ 839,879
Garment hanger, G. W. Cook........ 840,045
Garment pad, J. E. Mathieu........ 840,149
Gas and coking, apparatus for making, L. P. Lowe 839,939
Gas burner, P. Seiler 840,092
Gas engine, D. M. Tuttle 840,178
Gas generator, J. D. Dawson 840,115
Gas generator, acetylene, C. W. Waymire. 840,097
Gas producer, P. Eyermann 840,447
Gas seal box and washer, combined, I. N. Enright 840,445
Gear, change speed, F. A. Ferguson........ 840,055
Gear, transmission, J. Schmidt, Jr........ 840,383
Gear, variable speed, J. P. Davis........ 840,202
Gearing, alternating rotary, S. Lee........ 839,863
Gearing, worm, S. Otis 840,157
Glass-drawing method and apparatus, sheet, I. W. Colburn 840,433
Glass plates, mold for blown, S. I. Butters. 839,987
Glass tank, M. J. Owens 840,245
Glassware manufacturing apparatus, hollow, F. A. Grosse 840,056
Governor, R. L. Johnson 840,340
Grader and scraper, combined, G. E. Le Clair 840,139
Grader, road, L. Matthews 840,075
Grader, road, E. Fahrney 840,305
Grain and ear-corn elevator, B. Cunningham 839,814
Grain drill, D. A Schutt........ 840,020
Gramophone speed indicator, C. A. Cornwall 839,920
Grinding machine, calendar roll and knife, J. Linton 840,072
Gun, magazine, W. H. Gates........ 840,309
Guns, revolver attachment for, J. Adrianson 839,978
Gyratory crusher, J. B. Rhodes........ 839,891
Gyratory crusher, W. A. Spring........ 839,901
Halter, H. Bramer 839,980
Hammer controlling means, W. W. Word.. 840,033
Hammer, magnetic tack, J. A. R. Damonte. 840,441
Hanger, J. H. Herbener 839,843
Harrow, F. Adix 839,799
Harrow, E. H. Peters 839,887
Harrow, folding, F. Adix 839,800
Harrow rider attachment, F. Adix........ 839,801
Harvester attachment, H. E. Johnson........ 840,338
Harvester, beet, W. E. Sleight........ 840,166
Harvester, cane, Melancon & Mayor........ 839,945
Harvester cutting apparatus, C. L. Hummel 839,850
Harvesting and cultivating machines, guide for root, G. F. Conner........ 839,918
Hay loader, H. J. Lormis 840,351
Header reel, adjustable, R. H. Ackerman... 840,411
Heater, W. F. McGuire 840,235
Heating materials, electrically, C. L. Collins, 2d 840,044
Heel cushion, J T. Story........ 840,170
Helix-forming machine, T. E. Drohan........ 840,050
Hinge, G. Holden 839,847
Hinge attachment for screen doors, spring, R. R. Suter 840,396
Hinger hanger, A. Schroeder 839,963
Hoisting bucket, automatic dumping and righting, W. T. Krausch........ 839,858
Hoisting machine, A. E. Handy........ 840,129
Hook and eye, B. F. Gable........ 840,205
Hook and eye, J. S. C. Sowar........ 840,266
Horse controlling device, J. G. Michaeli.... 840,079
Hose nozzle, F. J. Christman........ 839,811
Hose or tubes, machine for manufacturing, C. Hyde 839,851
Hose supporter, J. Mann 840,355
Hose supporter clasp, P. S. Bauer........ 840,289
Hot water bags, electric heating attachment for, C. V. Hill 839,928
Hot water bags, heating attachment for, C. V. Hill 840,060
Hub, J. E. Sapp 840,379
Hub cap, J. W. Summers........ 840,172
Hydraulic and pneumatic apparatus, H. Jones 840,065
Hydrocarbon burner, Blain & Smith........ 840,292
Ice cream freezer, L. Sturges........ 840,171
Insulator, A. Johnson 840,336
Journal lubricating device, car axle, Harrison & Williams 839,840
Keyless lock, O. M. Farrand........ 840,054
Ladder, H. W. Pease 840,365
Lamp, G. Hacker 840,319
Lamp, electric, P. Muschenheim 839,869
Lamp, signal, F. D. Spear........840,025, 840,026
Lantern globe lifting attachment, F. A. Schwertner 840,261
Latch, sliding door, R. Campbell........ 840,297
Latches, bolt for rim, W. A. Marbach.... 840,225
Lathe, automatic, G. W. Pringle........ 840,369
Lathe heating device, spinning, R. Thiel... 840,270
Lathe spindle, J. Hartness 840,322
Leather treating machine, W. B. Turner... 840,029
Ledger and index, combination, A. F. Thompson 840,175
Lens, bifocal, H. C. Joerden........ 839,998
Life-belt, A. Gros 840,318
Lifting mechanism, J. R. Miller........ 840,082
Lightning arrester, M. O. Troy........ 840,028
Lightning arrester connection, E. A. Baldwin 840,036
Lime hydrating apparatus, M. Mauran........ 840,076
Liquid separator, centrifugal, C. H. Hackett 840,057
Load binder, A. L. Cox........839,990, 839,991
Loading device, B. S. Crocker........ 839,921
Loading machine, F. K. Holmested........ 839,997
Lock. See Keyless lock.
Lock and latch, combined, L. H. Mullikin. 840,007
Lock bolt, A. Dumont 839,821
Locking mechanism, jail, W. R. Kales........ 839,933
Locomotive, Reid & Ramsay 840,255
Locomotive, G. G. Davis 840,442
Locomotive tender, W. L. Baskins........ 840,038
Log transfer, S .L. Vance........ 839,971
Loom filling-detecting mechanism, C. F. Roper 840,377
Loom, pile fabric, H. Sarafian........ 840,257
Loom, pile fabric, F. A. Whitmore........ 840,275
Loom, warp stop-motion, J. Bim........ 840,196
Looms, device or automatically stopping, C. Adams 840,034
Lubricator, O. A. Shipley 840,094
Machine driving means, P. E. Clark........ 840,199
Machinery tripping mechanism, C. E. Glessner 840,127
Mail box, J. Becker 840,290
Mail, index cell-case equipment for delivery of, Howard & McKee........ 840,332
Masts, pipes, hollow piles, etc., process and apparatus for manufacturing hollow, H. Siegwart 839,895
Meal from wheat and other farinaceous products of poor baking quality, production of, L. Rappeport 839,889
Measure for fabrics, G. W. Davis........ 840,047
Measuring quantities of liquid, arrangement for, T. Hillmer 840,210
Meat cutting machine, F. A. Capener, et al. 840,041
Metal articles, means for making hollow, Schumacher & Tyson 840,091
Metal bending machine, R. D. Patterson... 839,951
Metal swaging apparatus, O. Briede........ 840,426
Meters, record slip for, G. E. Hawkins.... 839,927
Micrometer gage, B. A. Marsh........ 839,943
Millboard making machine, W. Sillman, 840,386, 840,387
Minerals, roasting of pyritous, G. Rambaldini 840,253
Miner's gold pan, T. Hussey........ 840,333
Mitering machine, W. Battensby 839,807
Motive power engine, L. M. Kellogg........ 839,999

Motor regulator, alternating current, C. Renshaw	839,958
Motors, phase-adjusting means for alternating current, B. G. Lamme	839,935
Motors, regulating alternating current, Lamme & Renshaw	840,001
Motors, regulating the speed of electric, B. G. Lamme	839,937
Music recording device, Swing & Graner	840,397
Musical instrument, mechanical, Schnabel & Lawson	840,259
Musical instrument, pneumatically operated, F. V. Crofut	840,303
Musical instruments, automatic mechanism for playing, A. E. Olney	839,880
Necktie holder, J. L. Sutherland	840,173
Nozzle wagon, G. H. Bardsley	840,287
Nut lock, W. D. Leonard	840,143
Nut lock, D. W. Patton	840,249
Nut lock, J. B. Smiley	840,390
Oil burner, crude, J. Harleman	840,059
Oil burner, crude, M. A. Fesler	840,448
Oil its tarry or asphaltic constituents, with gas as a by-product, apparatus for recovering from, L. P. Lowe	839,940
Ore separator, M. R. Lyle	840,354
Organs or harmoniums, instrument for playing, J. H. Dawe	840,048
Oxyhemoglobin, making a solution of, W. J. J. Hendrikszoon	840,326
Packing for rocking or rotating rods or shafts, metallic, A. D. Morris	840,358
Packing, metallic piston, N. Pflaum	840,250
Packing, piston, J. J. Redner	839,890
Packing ring, A. E. Sparrow	839,900
Packing, self-acting membrane, P. Wirsching	840,408
Pad. See Garment pad.	
Painter's striping and stenciling wheel, C. L. Garrecht	840,308
Paper-bag machine, W. A. Loreaz	840,073
Paper-making machine, S. Milne	840,228
Paper-making machines, feed mechanism for calender rolls of, R. Smith	839,966
Paper retaining device, G. W. Donning	840,118
Peanut shock protector, J. L. Bangley	840,420
Peeler, vegetable, J. & F. Kerr	840,000
Pen, fountain, B. B. Goldsmith	840,456
Pen, ruling, Alexander & Fox	840,413
Pencil holder, S. J. Lester	840,349
Pencil sharpening machine, F. E. V. Baines	839,806
Pencils, eraser tip for lead, L. J. Reckendorfer	840,372
Pendent switch, H. C. Wirt	840,182
Perfumery package, J. Blocki	840,105
Permutation lock, E. E. Quaintance	840,088
Phase-adjusting apparatus, B. G. Lamme	839,936
Phonograph and disk holder, W. C. Spurgeon	839,902
Phonograph sound regulator, A. H. Ryder	840,089
Photographs, exhibiting diffraction, F. E. Ives	839,853
Pianissimo device, Reeps & Nott	840,254
Piano action, R. M. Squire	839,903
Piano and organ keys, machine for laying off patterns on and otherwise preparing boards for the manufacture of, F. Schneider	840,260
Piano, mechanically operated, F. V. Crofut	840,302
Piano players, sheet-winding mechanism for, F. P. Smith	840,024
Piano tool, J. N. Brown	840,294
Pile and forming the same, A. A. Raymond	839,954
Pipe flanging machine, C. R. McKibben	840,154
Pipe hanger, J. E. Johnson	840,337
Pipe tension joint, F. McCluskey	839,947
Pipes, reservoirs, and the like of strengthened cement and concrete, skeleton for, F. E. Bocquet	840,293
Pistol, magazine, J. H. Wesson	839,911
Piston rod connection, L. Anderson	840,190
Pitman connection, W. H. Glassburn	840,455
Plane, carpenter's, W. F. Arnold	840,418
Planter and fertilizer distributer, seed, F. H. Weaver	840,274
Planter, corn, L. R. Gilchrist	840,454
Plastic materials, machine for molding, A. Lutze	839,941
Platform, dumping, F. W. Cooley	839,813
Pliers, C. A. Fritz	839,993
Plow, A. Lindgren	840,350
Plow, M. Pearson	840,364
Plow and seeder, F. Thurrid	840,177
Plow attachment, T. Wiegert	840,405
Plow, cotton thinning, W. A. Edgin	839,827
Plow handle, F. R. Stewart	840,393
Plow, wheel, G. W. Barnett	840,421
Pneumatic tree, D. M. Reid	840,160
Pneumatic tube system, B. C. Batcheller	840,194
Polishing composition, making a, M. & E. Springborn	840,167
Potato masher, A. T. Stewart	840,392
Powder distributer, C. H. Leggett..840,141,	840,142
Powder, pattern, G. Pinkus	840,251
Power transmission device, F. de Coligny	839,989
Pressure gage, W. H. Bristol	839,982
Pressure indicator and recorder, W. H. Bristol	839,981
Printers' rollers, machine for cleaning, C. B. Cutler	840,440
Printing and like machines, device for feeding sheets to, F. E. Hodgkinson	840,211
Printing attachment, address, W. L. Bucksen	840,429
Printing machine, yarn, W. E. Lyford	840,353
Propeller, boat, S. N. Edgar	839,826
Propeller, marine, O. P. Smith	839,897
Pulley casing, sheet metal, F. E. Sloan	840,265
Pulley for pulverizing mills, G. E. Rudnick	840,162
Pulley, sheet metal sash, F. E. Sloan	840,389
Pump, H. Jones	840,064
Pump, T. Butler	840,430
Pump base, Lea & Degen	840,138
Pump casing, multiple section, Lea & Degen	840,137
Pumps, means for balancing centrifugal, J. Degen	840,116
Puzzle, L. B. Lincoln	840,144
Rail fastener, W. P. Johnson	840,219
Rail joint, M. Nemecek	840,239
Rail joint, J. H. Price	840,368
Rail joint, J. E. Beaver	840,424
Rail securing device, track, W. Scott	839,894
Rail tie and fastener, W. F. Walker	839,972
Railway stock guard, W. E. Wahlin	840,030
Railway tie, McLean & Swanson	839,874
Railway vehicle coupling, E. Ulbrich	839,907
Railway weigh bridge, E. von Miklos	839,946
Railways, contact shoe for electric, H. C. Pealow	840,087
Railways, sound-deadening means for, J. Schenbeck	840,258
Rakes, frame construction for side delivery, H. B. Sperry	839,968
Ratchet device, feed, G. T. Reiss	839,957
Razor, J. A. Reams	840,371
Razor, safety, F. H. Arnold	840,101
Razor, safety, D. W. & E. H. Odell	840,244
Razor, safety, J. J. Fetzer	840,449
Record-producing machine, G. W. Donning	840,117
Recorder. See Scale recorder.	
Reflector, F. Muller	840,084
Reservoirs, controlling means for fluid, J. L. Schureman	840,163
Rheostat, motor starting, P. H. Zimmer	840,186
Roller table, C. L. Taylor	840,398
Roofing, laying, R. W. Bird	840,103
Rope carrier, fall, Delaney & Lambert	840,443
Rope clamp, M. F. Smith	839,965
Rotary engine, W. Suce	839,967
Rubber composition ball and making the same, hard, E. F. Upton	840,401
Rubber heel, safety, E. G. Perkins	839,886
Rubber mat, R. K. Gray	839,834
Ruling appliance, L. Holzermann	840,331
Sad-iron handle, J. R. Cochran	840,043
Safe bolt mechanism and lock, W. H. Taylor	840,269
Sandpapering and polishing machine, D. McDougall	839,872
Sash fastener, J. L. Grether	840,317
Sash holder and fastener, A. M. Brister	840,427
Sash lock, window, S. W. Ekroos	839,828
Saucepan lid, J. W. Woolven	840,184
Saw gage and jointer, J. P. Olson	840,155
Saw handle, crosscut, A. S. Patton	840,363
Saw-setting machine, Watkins & Dye	839,909
Sawing machine, Gray & Horning	840,314
Sawing machine, O. C. Hoar	840,330
Sawing machine, J. G. Pedley	840,366
Scale recorder, F. B. Hays	839,841
Seal, L. A. Foote	840,125
Seal, car door, C. Columbus	840,434
Seat back for drivers' seats, R. H. Yale	839,976

How to Construct An Independent Interrupter

In SCIENTIFIC AMERICAN SUPPLEMENT, 1615, A. Frederick Collins describes fully and clearly with the help of good drawings how an independent multiple interrupter may be constructed for a large induction coil.

This article should be read in connection with Mr. Collins' article in SCIENTIFIC AMERICAN SUPPLEMENT, 1605, "How to Construct a 100-Mile Wireless Telegraph Outfit."

Each Supplement costs 10 cents; 20 cents for the two. Order from your newsdealer or from

MUNN & CO., 361 Broadway, New York

Selling machine, automatic, W. Abel....... 840,281
Separator, W. M. Cook 840,301
Sewage purifying apparatus, A. Vogelsang.. 840,179
Shade adjuster, ball-bearing window, J. Renner 840,373
Shafts, means for indicating relative movement of parts of rotating, A. Amsler.. 839,803
Sharpener, knife, B. Nichols 839,877
Shaving cup, C. W. Taylor 839,970
Sheet delivery mechanism, counting and collating device for, F. Waite 840,402
Sheet metal hanger legs, apparatus for forming, H. T. Hallowell 839,830
Shock-handling attachment for crop-treating machines, J. B. Schuman 840,019
Shock loader, J. L. Sharpe, Jr. 840,021
Shoe tree, W. L. C. Niles 840,008
Shut-off, automatic, T. F. Goodfellow 840,312
Shuttle-box operating mechanism, H. Cane.. 839,988
Signal, F. Marwede 840,356
Signal apparatus, W. B. Lane 840,135
Signaling apparatus, electrical, J. D. Peachey 840,150
Signaling system, electrical, E. R. Brodton. 840,428
Silk, weighting, C. Simon 840,264
Skid setting gage, F. Hughes 839,932
Skirt, hoop, M. J. Hoase 839,931
Snow thawing machine, W. Elliot 840,444
Soap molding battery, F. Holoubek 840,213
Sole trimming and channeling machine, shoe, Small & Campbell 839,896
Specialist's chair, C. N. Leonard 840,348
Spinning machine top roll, W. G. Ragsdale. 840,010
Splice bar, W. J. Mattern 840,074
Sprocket chain, G. C. Horst 839,849
Stairway, spiral, G. Holden 839,846
Staple blank or strip, E. T. Greenfield 839,836
Staple puller, T. J. Alsop 839,802
Steel connecting bar, pressed, N. McInnes.. 840,237
Stencil frame, J. S. Duncan 840,052
Stencil perforating device, S. Pryor 839,888
Stereotype apparatus, casting box for, J. L. Firm 839,924
Sterilizer, H. P. Bacon 839,805
Storm apron, A. J. Miller 840,081
Stove, C. Ayres 839,804
Street cleaning machine, F. Ebner 839,823
Stretcher frame, E. McCombie 840,232
Stuffing box, M. Berecky 840,291
Sunken bodies, apparatus for searching of, M. von Schoultz 840,018
Superheating boiler, Burger & Williams 839,808
Surveying bore holes, means for, H. F. Marriott 840,148
Suspenders, C. A. Murray 840,359
Switch. See Electric switch.
Switchboard cord reel, E. B. Craft 840,200
Tachometer, F. M. Carroll 839,916
Tank supporting structure, A. K. Mansfield. 839,942
Tape punching register, J. L. Du Frane... 840,051
Target trap, J. W. Haughawout 840,323
Telegraph, duplex, J. W. Larish 840,002
Telephone book switch, G. D. Foster 840,202
Telephone system, H. G. Webster 839,810
Telephone transmitter, A. Larsson 840,069
Tent stake, N. S. Dunnington 839,822
Testing device, A. M. Mattice 840,005
Thermo-electric generator, W. H. Bristol, 839,984, 839,985
Thermostatic apparatus, K. Rostel 840,256
Thill or tongue support, L. L. Roark 840,012
Thinner, W. B. Moss 840,229
Threshing machine feeder, C. D. Markey 839,865
Threshing machines, automatic pitcher and self-feeder for, G. C. Wiles 840,276
Tide motor, J. E. Lemyre 839,860
Time detector, watchman's, J. Zausner 840,410
Tire, G. E. Heyl-Dia 840,209
Tire-releasing tool, clencher, Glickert & Swigert, Jr. 840,207
Tires, making shoes for pneumatic, J. W. Hyatt 840,334
Tobacco cutting machine, L. Aptekman 840,416
Tobacco stemming and booking machine, B. McGregor 840,234
Toy battleship, W. T. Wood 840,409
Toy crossbow, G. H. Sawdy 840,015
Transformer, W. S. Moody 840,150
Transformer, steam, S. Otis 840,158
Trestle, J. M. Normand 840,360
Truck, railway car, S. Otis 840,156
Trunk, F. M. Lee 840,140
Tunnel and constructing the same, R. H. Keays 839,856
Tunneling through rocks, P. Ford 840,307
Turbine, R. H. Goldsborough 840,310
Turbine, compound steam, F. Burger 840,039
Turbine, elastic fluid, R. H. Rice 840,376
Turbine, steam, H. P. Hill 840,457
Turbines, diaphragm and nozzle construction for, O. Junggren 840,132
Turbo-generator, J. G. Callan 840,040, 840,431
Turpentine gathering receptacle, H. M. Winchester 840,181
Type-bar machine, Kletzker & Goesel...... 840,346
Typewriter, G. W. Donning 840,122
Typewriter attachment, J. Edwards...... 840,123
Typewriter attachment, R. W. Scoggin.... 840,384
Typewriter, electrical, G. W. Donning..... 840,121
Typewriter selecting and operating means, electrical, G. W. Donning 840,120
Typewriter work guide, G. W. Donning.... 840,119
Typewriting machine, H. L. Wagner...... 839,908
Umbrella holder, expanded, E. Nootbaar.... 840,241
Umbrella support, A. J. Adams...... 840,188
Umbrella support, J. C. Williams...... 840,406
Valve, H. Jones 839,854, 839,855
Valve, A. Harkness 840,058
Valve, C. D. Ballard 840,286
Valve, J. H. Simms 840,388
Valve, check, N. C. Locke...... 839,862
Valve, compression and vacuum relief, E. B. Whelan 839,912
Valve, engine, O. W. Young...... 840,185
Valve for steam-heating systems, automatic relief, T. F. Dexter 840,304
Valve, gate, N. W. Race...... 839,953
Valve, non-return, J. R. Tanner...... 840,174
Vegetable matter, apparatus for recovering products from, J. H. Partridge...... 840,362
Vehicle, S. D. Maddin 840,146
Vehicle body support, E. G. Hines...... 839,845
Vehicle footboard, adjustable, J. Hage...... 839,838
Vehicle gear, F. E. Wilcox...... 839,913
Vehicle, pleasure, Adams & Divens...... 840,283
Vehicle runner, Hoag & Krieger...... 839,929
Vehicle suspension device, G. Diezemann.... 840,049
Vending machine, J. Vierling 840,272
Veneer drying and straightening machine, F. N. Morey 839,868
Ventilator, F. L. Hargreaves 840,321
Vessel cover and liquid shaker, H. Paton.. 839,950
Veterinary forceps, M. Savidge 840,380
Volute spring, A. Stucki 840,027
Voting machine, C. M. Warner...... 839,975
Wagon, boulevard and speed, E. E. Bullock. 839,986
Wagon brake, transfer, N. C. Bassett...... 840,423
Wagon, dumping, R. M. Wilson...... 840,407
Wagon loader, E. E. Rothacher...... 839,961
Wagon, transfer, N. C. Bassett...... 840,422
Wall brace or tie, A. T. Lewis...... 840,071
Walls, collapsible core for plastic building, W. E. De Lhorbe 839,818
Walls, form for plastic building, W. E. De Lhorbe 839,819
Washing machine wringer support, W. S. S. Rodgers 840,161
Watchcase pendant, A. A. Stenhouse...... 840,096
Water closet seat, C. Willms...... 840,032
Water closet seat, F. W. Kingsbury...... 840,342
Water closet tank, F. W. Kingsbury...... 840,341
Water cooler stand, collapsible, J. C. Hylton 840,130
Water heater, W. Kane 840,220
Water or other liquids, effecting the destruction of pathogenic organisms in, P. G. Griffith 839,926
Water purifying and filtering apparatus, electric, J. A. Hyle 840,335
Water tube boiler, F. Z. Sherer...... 840,093
Wave motor, F. Starr 840,460
Weed exterminator, E. F. Cameron...... 839,810
Weeder, A. McRae 839,875
Well jack, oil, J. W. Rhoades...... 840,374
Wheel. See Painters' striping and stenciling wheel.
Whiffletree hook, J. McClelland 840,152
Windmill, M. V. Hartong 840,208
Windmill, R. L. Longley 840,458
Wire stretcher, A. Miller 840,080
Wires or filaments, making refractory metallic, Parker & Clark 840,246
Woodworking machine, F. W. Greene...... 840,316

Classified Advertisements

Advertising in this column is 50 cents a line. No less than four nor more than ten lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

SALE AND EXCHANGE.

MEMORIALS OF THE HUGUENOTS IN AMERICA. —Historical and biographical. 8vo. Cloth. Illustrated with steel and half-tones and gives information concerning nearly 1,000 Huguenots, who came to America in Colonial days. Balance of edition offered at $1.00 per copy, just *half* the original subscription price—postpaid. For particulars address Huguenot Publishing Co., Box 23, Wrightsville, Pa.

FOR SALE—A one-half interest in all foreign countries in a Wire and Wireless Automatic Railroad Signal. Best on market. Also Trolley Cut-out, which renders live wires dead when it breaks. All for Five Thousand Dollars. Will pay to investigate. C. C. Phillips, Owensboro, Ky.

WANTED.—Copies of our "Manufacturer's Index" issued some eight years ago. State price. Munn & Co., 361 Broadway, New York.

FOR SALE.—Engine Lathe, swings 9½ in. takes 25 in. between centers; complete with full set change gears to cut all size threads, 3 to 40 in.; price only $41.00. Address L. F. Grammes & Sons, Allentown, Pa.

BUSINESS OPPORTUNITIES.

$5.75 PAID FOR RARE 1853 QUARTERS.—Keep all money coined before 1875 and send 15 cts. at once for a set of 2 coin and stamp value books. It may mean a fortune to you. C. F. Clarke & Co., Dept. 14, Le Roy, N. Y.

WE ARE IN POSITION to secure capital, special or active partners for good, sound business propositions; we have several clients on hand who will consider business openings that will stand thorough investigation. Sam'l T. Bondhus & Co., 97-99 Nassau St.

WANTED. Several high class representatives, local and traveling, to sell a new store necessity which sells for $50 to $500. We will send you the names and addresses of 2,000 satisfied users. Our proposition is high class, bonafide and pays nearly 60 per cent. Our references, First Ntl. Bank, Chicago, and 2,000 satisfied users. Some capital required for stock. Amount depends on territory. Money back if desired. State reference, confidential and qualifications and we will submit contract. Pitner Co., 183-189 Lake St., Chicago.

INCORPORATE.—Conduct your business by modern methods and avoid individual liability. We attend to all the details and furnish capital for favorable enterprises. Representatives in all States. Write for information today. The Corporation Company of America, 68 William St., New York.

DON'T WEAR OUT YOUR BRAIN adding figures. Buy a "Locke Adder." Rapid, accurate, simple, durable. Capacity 999,999,999. Price only $5.00. Booklet Free. C. E. Locke Mfg. Co., 25 C St., Kensett, Iowa, U. S. A.

LEARN TO INVENT and develop your ideas for profit; we are not patent lawyers. Boston School of Inventing, P. O. Box 3566, Boston. Further particulars free.

A FEW DOLLARS will start a prosperous mail order business. We furnish catalogues and everything necessary. By our easy method failure impossible. Write today. Milburn-Hicks Co., 718 Pontiac Building, Chicago.

AMAZING SCIENTIFIC DISCOVERY and invention combined. Science finds fountain of youth. Devices that transform electricity into magnetism and which aid to revitalize the human body, thus prevents or cures disease. Send for Prospectus of Facts insuring tremendous profits for investment in stock of the Bachelet General Magnet Co., manufacturers of the Bachelet Therapeutic Magnetic Wave Generators, convenient for use in every home. Price $50 up. Address H. C. Walker, 11th Floor, Flatiron Building, New York.

FOR SALE.—Portable Compressed Air House Cleaning Wagons and Machinery sold to responsible parties to operate in cities of from five thousand inhabitants upwards. Each Portable Cleaning Plant has an earning capacity of from $50.00 to $70.00 per day, at a cost of about $8.00 per day. Capital required from $2,000.00 upwards. Stationary Residential Plants also from $350.00 upwards. Over 100 companies operating our system. We are the pioneers in the business, and will prosecute all infringers. State references. Address General Compressed Air House Cleaning Co., 4453 Olive Street, St. Louis, Mo.

I SELL PATENTS.—To buy or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

WE MANUFACTURE METAL SPECIALTIES of all kinds. Best equipment. Send sketch or model for estimate, stating quantity. Hayes Manufacturing Co., 465-75 Maybury Avenue, Detroit, Mich.

HELP WANTED.

STEEL SALESMAN. Wanted a salesman for High-Grade Carbon and Alloy Tool Steel. Applicants will please give reference and state salary expected. Salesman, Box 773, New York.

ENGINEERS.—Civil, Electrical, Mechanical, Structural. Wanted for responsible positions at $1,000-$5,000. Services strictly confidential. Offices in 12 cities. Write us to-day. Hapgoods, 305 Broadway, New York.

WANTED.—A Foreman to take charge of machine shop in manufacturing plant, having from 12 to 14 machinists in his charge. Applicant must be thoroughly posted in the manufacturing of blanking and drawing dies. Good position for the right party. State salary and give references. Foreman, Box 773, New York.

SITUATIONS WANTED.

DRAUGHTSMAN.—First-class, expert designer of Automatic and Electric Machinery, Grad. Mech. Engineer of unusual ability is open for engagement. Also private work. M. A. Sidon, 1015 Jennings St., Bronx, N.Y.

PARTNERS WANTED.

AIRSHIP. Radically different in principle and construction from anything heretofore conceived of by all experimenters in both schools of Aeronautics. No theories, but practical demonstrated fact. Want party to furnish capital to acquire patents in principal countries. Half interest given in all patents. Address Jos. Henault, Los Angeles, California.

TYPEWRITERS.

WHY PAY $100 for typewriter? We sell Remingtons, Underwoods, Smith Premiers, Olivers, New Century, and all other makes from $10 to $40. N. J. Typewriter Exchange, 89 Montgomery St., Jersey City, N. J.

A FEW NEW Underwoods, Olivers, Franklins Smith Premiers and other makes from 25 to 50 per cent. less manufacturers price. All guaranteed. Quantity limited. Standard Typewriter Exch., Suite 54, 231 B'way, N. Y.

TYPEWRITER "Bargain List" free. Deal direct, save agents' commissions. Underwoods, Remingtons, Olivers, $38; others $15, $25, shipped on trial. Old Reliable, Consolidated Typewriter Ex., 243 Broadway, N.Y.

SCHOOLS AND COLLEGES.

PATENT LAWS AND OFFICE PRACTICE.—Thoroughly practical course by mail for attorneys and inventors. Postal brings free specimen pages and full information. Cor. School of Patent Law, Dept. A, 1853 Mintwood Place, Washington, D. C.

PROFESSIONAL CARDS.

ANALYTICAL CHEMIST.—Problems of a chemical nature solved. Any sample of manufactured specialty analyzed and will show you how to make it. Exclusive formulas devised for special needs. Ores assayed. Waters, minerals and commercial products accurately tested. For further information address Carl A. Black, B.Sc., Bratenahl Block, Cleveland, O.

PATENTS FOR SALE.

MAIL-BOX PATENT FOR SALE.—Automatic signal, simple durable construction for either rural or city delivery. For full particulars, address Wm. T. Morrow, Ada, O.

WANTED.—Purchaser Canadian rights (just issued) of "Rapid" Turbine Tube Cleaner. Adopted U. S. Navy. Guaranteed superior to any. Free trial machine for tests. Andrews Mfg. Co., Rockaway, N. J.

PATENTS SOLD ON COMMISSION.—If you wish to buy or sell a patent write for particulars to E. L. Perkins, 72 Broad Street, Boston. Patent Sales Exclusively.

FACTORY AND MILL SUPPLIES.

FACTORIES, CUT DOWN YOUR INSURANCE by putting in a Caldwell Tank and Tower for fire protection. Once up, no further expense. Endorsed by all insurance companies. References in every section. Arkay Stave Co., of Columbus, Miss., says: "Saves us $20 a month." Illustrated Catalogue and Price List free. W. E. Caldwell Co., Station D D, Louisville, Ky.

FOUNTAIN PENS.

FILLS ITSELF BY A BREATH.—No sticky threads, no leaky joints. Can't leak. Positively cleanest, most practical fountain pen made. Get catalogue. S. C. Crocker Pen Co., 79 Nassau St., New York.

RIGHT FROM THE MANUFACTURERS.—The Langill Special Self-filler, 14-K Gold Pen warranted, No. 4, Full Chased and Hard Rubber. Send $1.00 money order. Langill F. P. & B. Co., 20 Front St., New York.

LET THE LARGEST Fountain Pen Manufacturer to the mail-order and export trade send you direct a 14-karat, solid gold, diamond-pointed, all hard rubber fountain pen for a dollar. Established 21 years. Ira S. Barnett, 21 Beekman Street, New York City.

IDEAL EYE MASSEUR.

THE SAFEST, SUREST AND MOST SCIENTIFIC Treatment for all Eye troubles and Headache. Send for Illustrated Treatise on the Eye, mailed free. The Ideal Co., 239 S. Broadway, New York.

PATTERNS AND MODELS.

AUTOMOBILE PATTERN WORK A SPECIALTY. —Phone No. 1374 Franklin, General Pattern and Model Co., 78 Centre St., N. Y. City. Write or telephone and our representative will be pleased to call.

PHOTOGRAPHY.

BLUE PRINT PAPER.—The finest made. Obrig Quality stands back of it. 4x5, 16c.; 5x7, 28c.; 8x10, 55c., each 2 doz. Postage add 3, 4 and 6c. Other sizes in proportion. Per roll, 42 in. by 10 yds., $2.25. Send for lists of photographic supplies. For full particulars address Obrig Camera Co., 147 Fulton Street, New York.

WE PHOTOGRAPH any thing, any where, any time. Building, Paintings, Plans, Models, Machinery, Estates, etc. Illustrations for Advertisers. The General Photographing Co., 1215 B'way, Daly's Theatre Bldg., N.Y. City

LUMIERE PLATES, PAPERS & CHEMICALS. For 30 years the standard in Europe. A free Sample for the asking. Write N. Y. Office, 11 West 29th St. Factories, Lyons, France, and Burlington, Vt.

GAS-LIGHTING APPLIANCES.

"SIMPLIQUE" ELECTRIC GAS LIGHTER. Simple; Economical. Household necessity where gas is used. Fits any standard dry battery. By mail $1.00. Without battery 50c. Wm. Roche, 388 Clerk St., Jersey City, N.J.

MACHINERY FOR SALE.

IF INTERESTED IN POWER for any kind of light manufacturing, electric lighting, marine or other purposes, get information on the most improved kerosene oil engine by sending for catalogue to Remington Oil Engine Co., 41 Park Row.

ALWAYS ON HAND, good second-hand machinery, also boilers and engines, dynamos and motors: from smallest to largest. Write us before ordering elsewhere. Liberty Machinery Mart, 138 Liberty St., New York.

BOOKS AND MAGAZINES.

"DIE GARTENLAUBE."—German Illustrated Semi-Monthly in 15 volumes, in excellent condition representing the years 1866, 1868, 1870 to 1873, 1879 and 1880 1886 to and including 1893. Also Schlosser's Weltgeschichte. (9 volumes) can be reasonably purchased by addressing F.W.G. Box 773, New York.

DRAMATIC.

PLAYS AND ENTERTAINMENT BOOKS.—Largest catalogue in the world sent free on application. For further information address Dramatic Publishing Co., 358 Dearbon Street, Chicago.

Wrench, J. W. Hielscher	840,329
Wrench, R. H. Anderson	840,415
Writing machine, E. B. Hess	839,995

DESIGNS.

Advertising stand, H. E. Ellsworth	38,395
Belt, M. Isenstein	38,396
Buckles, bale for trace, A. Mudra	38,392
Fabric, knit, E. H. Brown	38,397
Frame, G. H. Rice	38,393, 38,394
Rug, H. C. White	38,398
Shield, W. C. Codman	38,391

TRADE MARKS.

Accordions and concertinas, Lyon & Healy	59,200
Albumen compound containing phosphorus, Farbwerke vorm. Meister Lucius & Bruning	59,290
Ale, ginger, Read Brothers	59,149
Antiseptic, Farbwerke vorm. Meister Lucius & Bruning	59,185
Antiseptic germicidal liquid, G. H. Koch	59,198
Antiseptic preparation, Les Etablissements Poulenc Freres	59,228
Axes, George Worthington Co.	59,027
Baking powder, Southern Manufacturing Co.	59,210, 59,211
Beef oil or fat, Schwarzschild & Sulzberger Co.	59,297
Belt dressing, machine, Atlas Specialty Co.	59,082
Beverages, certain, Hygeia Distilled Water Co.	59,253, 59,254
Beverages containing caffein, non-alcoholic, Yermeth-Compagnie Lender & Co.	59,238
Biscuits and cakes, Tacoma Biscuit and Candy Co.	59,280
Blood purifier, G. C. Sanches	59,275
Blue, laundry, N. Thestrup	59,213
Boiler compound, vegetable, Canton Paint and Varnish Co.	59,285
Boot and shoe heel plates, metal, L. Sacks	59,041
Boot and shoe polish, M. J. McCormack	59,071
Boots and shoes, leather, A. W. Tedcastle & Co.	59,075
Boots and shoes, leather, W. W. Spaulding & Co.	59,123
Bottle stoppers, metallic cork-lined, Crown Cork and Seal Co.	59,021
Bread, comminuted, desiccated, H. Taylor	59,281
Brewers' pitch, Busch-Freund Brewers' Supply Co.	59,243
Butter, Charles W. Rudd & Son	59,126
Butter, G. W. Linn & Son	59,199
Butter, Conover Creamery Co.	59,222
Buttons, collar and cuff, C. N. Allen & Co.	59,015
Cacaos, chocolate, and preparations thereof, A. & W. Lindt	59,229
Calf, chrome-tanned, Beckwith & Niteman Bros.	59,152
Canned beans, H. von Glahn & Son	59,132
Canned corn, H. von Glahn & Son	59,090
Canned peas, H. von Glahn & Son	59,131
Canned tomatoes, corn, peas, and beans, Kokomo Canning Co.	59,006

Noteworthy Articles

ON TIMELY TOPICS

Each number of the Scientific American Supplement costs 10 cents by mail.

SEWAGE AND ITS DISPOSAL. A review of modern methods. By H. LEMMOIN-CANNON. SCIENTIFIC AMERICAN SUPPLEMENT **1551.**

ELECTRIC LIGHTING FOR AMATEURS. How a small and simple experimental installation can be set up at home. SCIENTIFIC AMERICAN SUPPLEMENT **1551.**

CHEMICAL AFFINITY. Simply explained by SIR OLIVER LODGE. SCIENTIFIC AMERICAN SUPPLEMENT **1547.**

CASE-HARDENING. By DAVID FLATHER. SCIENTIFIC AMERICAN SUPPLEMENT **1547.**

ELECTRIC IGNITION SYSTEMS. A comprehensive article by E. W. ROBERTS. SCIENTIFIC AMERICAN SUPPLEMENT **1546.**

CONCRETE. A general article on its merits and defects. SCIENTIFIC AMERICAN SUPPLEMENT **1543.**

REINFORCED CONCRETE. Some of its Principles and Applications with practical illustrations. SCIENTIFIC AMERICAN SUPPLEMENTS **1547, 1548, 1551.**

ELECTRONS AND THE ELECTRONIC THEORY are discussed by SIR OLIVER LODGE in SCIENTIFIC AMERICAN SUPPLEMENTS **1428, 1429, 1430, 1431, 1432, 1433, 1434.**

THE PANAMA CANAL is described from the engineering standpoint in SCIENTIFIC AMERICAN SUPPLEMENT **1359.**

WIRELESS TELEGRAPHY. Its Progress and Present Condition are well discussed in SCIENTIFIC AMERICAN SUPPLEMENTS **1425, 1426, 1427, 1386, 1388, 1389, 1383, 1381, 1327, 1328, 1329, 1431.**

HOW TO CONSTRUCT AN EFFICIENT WIRELESS TELEGRAPH APPARATUS AT SMALL COST is told in SCIENTIFIC AMERICAN SUPPLEMENT **1363.**

SUBMARINE NAVIGATION. An exhaustive review of the subject is published in SCIENTIFIC AMERICAN SUPPLEMENTS **1414, 1415, 1222, 1223.**

SELENIUM AND ITS REMARKABLE PROPERTIES are fully described in SCIENTIFIC AMERICAN SUPPLEMENT **1430.** The paper is illustrated by numerous engravings.

THE INTERNAL WORK OF THE WIND. By S. P. LANGLEY. A painstaking discussion by the leading authority on Aerodynamics, of a subject of value to all interested in airships. SCIENTIFIC AMERICAN SUPPLEMENTS **946** and **947.**

LANGLEY'S AERODROME. Fully described and illustrated in SCIENTIFIC AMERICAN SUPPLEMENTS **1404, 1405** and **1546.**

STEAM TURBINES. Their Construction, Operation and Commercial Application. SCIENTIFIC AMERICAN SUPPLEMENTS **1306, 1307, 1308, 1422, 1400, 1447, 1370, 1372, 1521.** The articles have all been prepared by experts in steam engineering.

PORTLAND CEMENT MAKING is described in excellent articles contained in SCIENTIFIC AMERICAN SUPPLEMENTS **1433, 1465, 1466, 1510, 1511.**

AERIAL NAVIGATION. Theoretical and Practical Discussions, Pictures and Descriptions of actually-built dirigible balloons and aeroplanes will be found in SCIENTIFIC AMERICAN SUPPLEMENTS **1161, 1149, 1150, 1151, 1404, 1405, 1413, 1455.**

THE TANTALUM LAMP. A full illustrated description of a lamp having a metallic filament and burning at once without preliminary heating appears in SCIENTIFIC AMERICAN SUPPLEMENT **1523.**

THE WATERPROOFING OF FABRICS is thoroughly discussed in SCIENTIFIC AMERICAN SUPPLEMENT **1522** by an expert.

THE SPARK COIL, ITS CONSTRUCTION AND MAINTENANCE, is the subject of a painstaking article in SCIENTIFIC AMERICAN SUPPLEMENT **1522.**

ELECTRIC IGNITERS FOR GAS ENGINES are discussed in SCIENTIFIC AMERICAN SUPPLEMENT **1514.**

CARBURETERS, a subject of immense importance to automobilists and the users of oil engines, is well treated in SCIENTIFIC AMERICAN SUPPLEMENT **1508.**

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in SCIENTIFIC AMERICAN SUPPLEMENT **1524.**

Each number of the Scientific American Supplement costs 10 cents by mail.

MUNN & COMPANY
361 Broadway New York

Paints and painters' materials, certain named Foy Paint and Glass Co. 59,061
Pants, coats, vests, and overalls, H. R. Stoepel 59,145
Paper and cardboard, certain named, Mittineague Paper Co. 59,166
Paper, drawing and tracing, E. G. Coltmann 59,171
Paper, fine writing, Whiting Paper Co. 59,176
Paper, toilet, Scott Paper Co. .59,074, 59,233, 59,234
Paper, tracing, E. G. Soltmann 59,170
Pegs, wooden, Kearsarge Peg Co. 59,257
Pens, steel, M. Voorsanger 59,111
Perfumes, etc., and certain named toilet preparations, Lazell, Dalley & Co. 59,260
Photographic plates, G. Cramer Dry Plate Co. 59,024
Pianos, E. G. Harrington & Co. 59,100
Pianos, A. L. Creed 59,159
Pianos, Hardman, Peck & Co. 59,163
Pickles and chow-chow, Griggs, Cooper & Co. 59,103
Piece goods or cloths, J. Lonke 59,068
Pineapple and sugar, combination of, Tropic Fruit Co. 59,078
Pineapple juice, sweetened, Tropic Fruit Co. 59,148
Pipe and solderless couplings and plumbers' tacks, Modern Improvements Mfg. Co. 59,035
Poisons for exterminating vermin, Oriental Comp. 59,270
Powder, stomachic, P. F. W. Barella 59,180
Powder, toilet, Amolin Chemical Co. 59,178
Powder, tooth, S. H. Gunder 59,250, 59,251
Powder, tooth, foot, and borated talcum, J. C. Allen 59,177
Propeller wheels for vessels, C. E. Hyde 59,064
Purses, leather, A. & E. Leather Goods Co. .. 59,217
Remedies, certain named, M. F. Adleman 59,288
Remedies, dyspepsia, Mother Seigel's Syrup Co. 59,294
Remedies for certain named diseases, Wells & Richardson Co. 59,174
Remedies for diseases peculiar to infants and teething children, J. A. House Medicine Co. 59,252
Remedies in tablet form, internal headache, Neuralgyline Co. 59,267
Remedies, poultry, J. M. Kelsch 59,258
Remedy for certain named diseases, Farbwerke vorm. Meister Lucius & Bruning. 59,160
Remedy for certain named diseases, Aschenbach & Miller 59,179
Remedy for certain named diseases, Calmetto Co. 59,245
Remedy for fever and whooping-cough, Farbwerke vorm. Meister Lucius & Bruning. 59,186
Remedy for indigestion, Glycosine Phosphate Co. 59,286
Rings, finger, Allsopp Bros. 59,055
Roofing material of composition or cement, Sparham-Fireproof Roofing Cement Co. .. 59,143
Roofing, ready tar and felt, Warren Chemical and Manufacturing Co. 59,045
Rubber and composition belting, hose, and machinery packing, Boston Belting Co., 59,155, 59,156
Rubber belting, hose, and machinery packing, Peerless Rubber Manufacturing Co., 59,107, 59,108
Rubber boots and shoes, W. McKittrick 59,135
Rubber boots and shoes, Hood Rubber Co. .. 59,196
Salve, J. Horn 59,197
Sausages, W. H. Easton & Co. 59,101
Scarfs, women's, W. Trevor 59,077
Seeding machines, Campbell Corn Drill Co. .. 59,125
Seeds for agricultural and horticultural purposes, Sutton & Sons 59,236
Sewing, crochet, embroidery, and knitting cotton, Clark & Co. 59,158
Shoes, leather, Augustus Wright Co. 59,240
Shoes, leather, W. R. & Auburn Lynn Shoes Co. 59,283
Shovels and spades, George Worthington Co. 59,026
Shovels, scoops, and spades, George Worthington Co. 59,025
Silks, dress, Norfolk Silk Co. 59,116
Silverware, imitation, International Silver Co. 59,049
Soap, Lever Brothers Co. .... 59,030 to 59,034
Soap, J. F. G. de Roussay de Sales 59,040
Soap, Colgate & Co. 59,047
Soap, Southern Cotton Oil Co. .59,141, 59,142, 59,209
Soap, laundry, Standard Soap Co. 59,043
Soap powder, Cudahy Packing Co. 59,183
Soda and saleratus, Church & Dwight Co. 59,096
Soda, saleratus, and baking powder, baking, Church & Dwight 59,095
Specific for eczema, E. Moreau 59,265
Spectacle and eyeglass lenses, W. W. Bissell 59,218
Spices, ground and whole, New Orleans Import Co. 59,086
Squares, mechanics', F. G. Bruel 59,046
Sugar, Postum Cereal Co. 59,204
Suppositories, W. S. Richardson 59,295
Suppositories, vaginal, G. H. Koch 59,293
Suspenders, A. D. Lobel 59,067
Tarry coating for raods, etc., Barret Manufacturing Co. 59,151
Tea and coffee substitutes, cereal, J. H. Shetter 59,278
Teas, Griggs, Cooper & Co. 59,102, 59,195
Tin and terne plate, N. & G. Taylor Co. 59,054
Tobacco, chewing, A. Schroer Tobacco Co. 59,239
Tobacco flavoring extracts, F. P. Dengler 59,099
Tobies or stogies, W. A. Springer 59,089
Toilet preparations, certain, Pompeian Mfg. Co. 59,202
Tonic and reconstructive, Ferromannin Chemical Co. 59,291
Tonics, T. M. Walsh 59,237
Tonics and remedies for dyspepsia, R. Preissler 59,273
Tools, combination, National Hitchet Co. 59,037
Varnish and stains, Eagle Paint & Varnish Co. 59,022
Vases, mugs, tankards, and clock cases, Owen China Company 59,117
Vitreous slabs or plates, Pressed Prism Plate Glass Co. 59,109
Washing compound, I. Myers 59,136
Waters, table, Equinox Co. 59,248
Weaners, calf, J. E. Griffith 59,048
Well drilling machines, G. D. Loomis 59,069
Whisky, W. L. Perkins & Co. 59,039
Whisky, J. Shapiro 59,052
Whisky, F. W. Hunt & Co. 59,084
Whisky, J. Livelar & Co. 59,085
Worsted, woolen, and cotton mixed piece goods, Griffon Co. 59,226
Wrenches and thread cutters or trimmers, combined, Hawkeye Wrench Co. 59,134

LABELS.

"Blood of the Grape Champagne," for non-intoxicating beverages, Wilson Fruit Juice Co. 13,299
"Clover Glen," for butter, G. A. Barber 13,301
"Coca-Cola," for a non-alcoholic beverage, Coca Cola Co. 13,298
"Golden Top," for ginger ale, American Bottling Co. 13,297
"Russell's Club Mogul," for playing cards, Willis W. Russell Card Co. 13,302
"Western Reserve Maple Syrup," for maple syrup, Western Reserve Syrup Co. 13,300

PRINTS.

"Ground Shells or Hens' Teeth," for ground shell, Long Beach Milling Co. 1,878
"Martha Washington Back, Congress Playing Cards, for playing cards, United States Playing Card Co. 1,876
"Men's and Boys' apparel," for men's and boys' apparel, H. C. Lytton 1,877
"Satisfied," for coca-cola, S. L. Whitten 1,874
"Temptation," for liquors, Meyercord Co. 1,875

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

The Great Question Answerer!!

IF YOU WANT TO KNOW

About AUTOMOBILES and MOTOR VEHICLES; their History, Construction, Operation and Development

IF YOU WANT TO KNOW

all the facts about **all modern subjects** of vital importance and every-day interest, consult **the one acknowledged authority:**

The AMERICANA

Published under the editorial supervision of

The SCIENTIFIC AMERICAN

A PRACTICAL WORK

ARCHITECTURE
ART
ASTRONOMY
SCIENCE
PHILOSOPHY
RELIGION
EDUCATION
LITERATURE
HISTORY
BIOGRAPHY
GOVERNMENT

EVERY IMPORTANT SUBJECT
WRITTEN AND SIGNED
BY RECOGNIZED AUTHORITIES

INDUSTRY
COMMERCE
SANITATION
FINANCE
ECONOMICS
CHEMISTRY
ENGINEERING
SURVEYING
MECHANICS
MATHEMATICS
ETC., ETC.

FOR PRACTICAL MEN

A New Departure

The **Americana** is a new departure in Reference Works. It is built upon an entirely new plan. Instead of giving a single article upon a subject, it gives a **series of articles,** each written by an expert authority—the whole constituting

A Complete Development of the Subject

The Americana

is so far in advance of all other works of reference as to

Mark a New Epoch

in the publishing world. It is so Original, Modern and Thorough as to be in a class by itself. It is

The Standard American Authority

of Modern Knowledge

The Most Magnificent, Scholarly, Original, Practical System of Reference in Existence

"TAKEN all in all we have no hesitation in saying that this great American production, in the extent and usefulness of its contents, in its technical arrangement, in its original conception and brilliant performance, is without a peer."—*Review of Reviews.*

Some idea of the magnitude of this work may be gained from the fact that it required an investment of more than **$1,500,000** to produce it.

Over Two Thousand Special Contributors

Comprising the greatest living American scholars and authorities

FREE ON REQUEST

No mere advertisement can convey an adequate idea of the vast interest and immense utility of the AMERICANA, or of its exceptional value and sumptuous appearance. Let us send you therefore a handsome **120-page book** containing **specimen pages, maps, full-page plates, duotones, color plates, and text illustrations,** with **portraits of celebrities,** full-page photographic plates **of the most interesting and up-to-date subjects—The Americana being the best illustrated of all reference works.** With the object of making the AMERICANA quickly and widely known, before placing the work in the hands of dealers for general distribution, we will accept orders direct at a large reduction from the established price. Those interested are requested to make application immediately. The work is sold exclusively in connection with the **SCIENTIFIC AMERICAN,** and cannot be otherwise obtained.

REQUEST BLANK

SCIENTIFIC AMERICAN COMPILING DEPT.
258 FIFTH AVENUE, NEW YORK CITY

Without obligating myself to purchase, I would like to receive FREE your 120-page Book of Specimen Pages, Maps, Duotones, Color Plates, Portraits, etc., of the NEW AMERICANA, with particulars of your special low price advertising proposition:

Name...

Occupation...

Street...

Town and State...

CUT OUT AND MAIL TO-DAY